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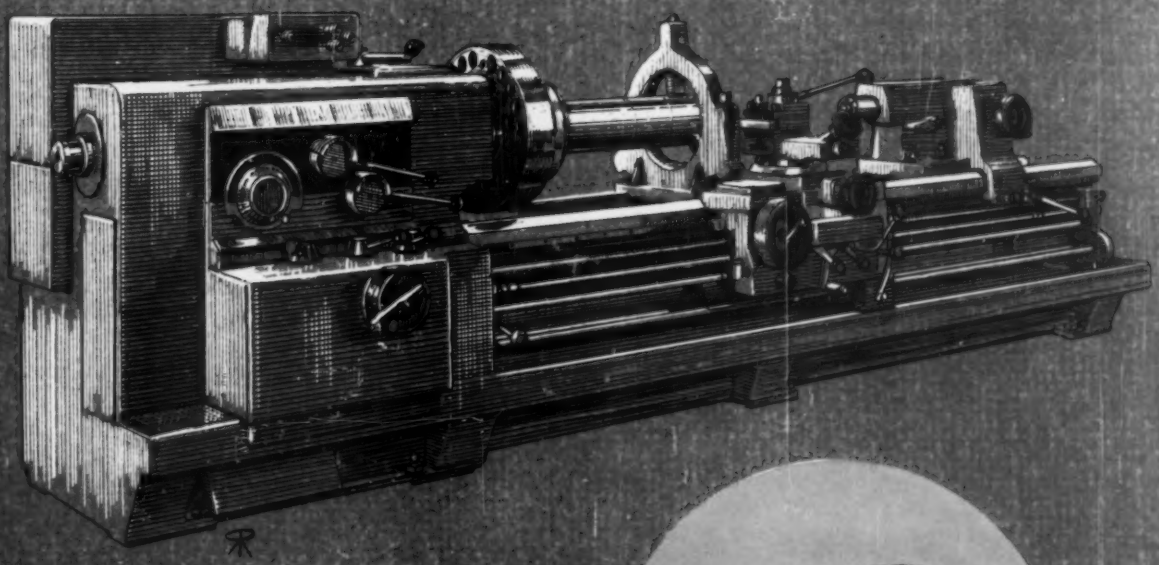
Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT



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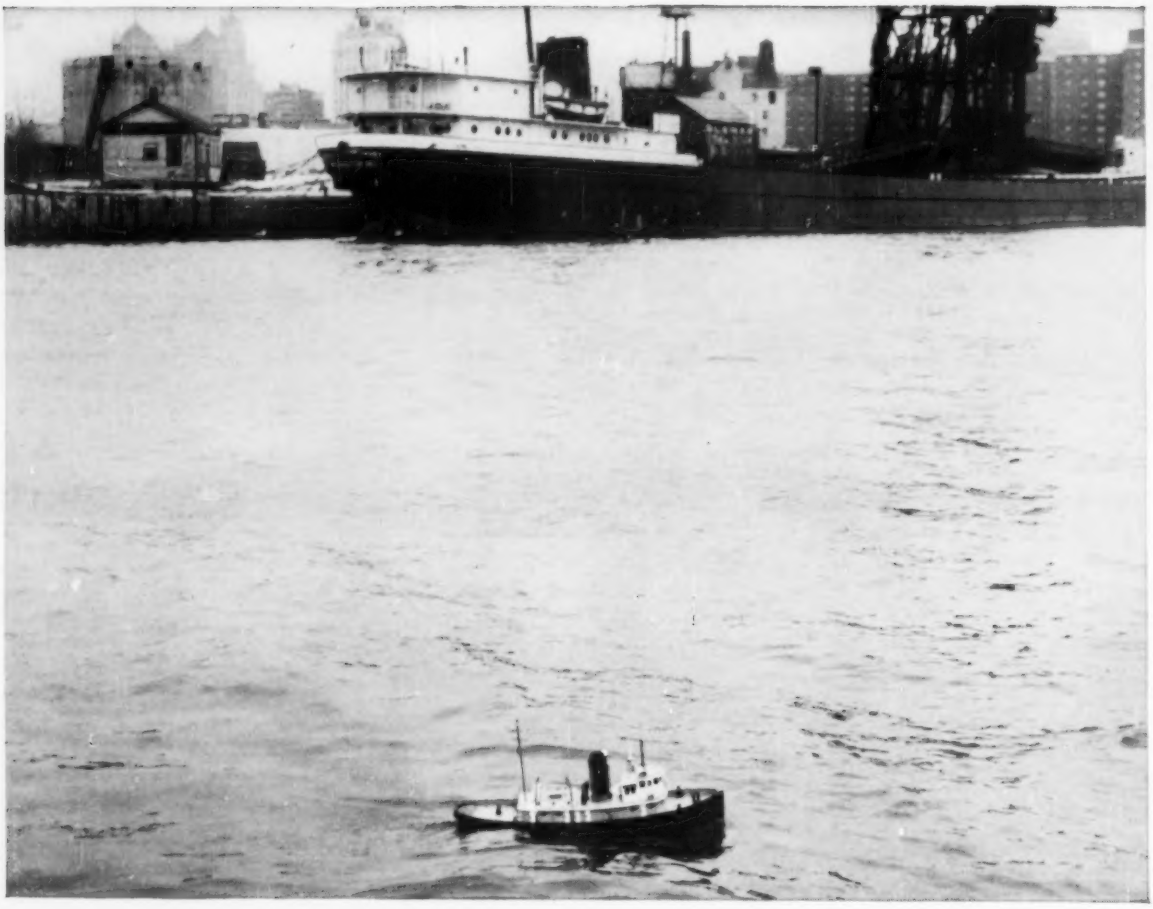

World's smallest Monel shaft delivers model performance

When radio-controlled *Polaris* sets out for a run on the Buffalo River, she's every inch a working tugboat. Although she's only 34 inches long, the river is as rough on her as it is on life-size boats.

Take her shaft, for example. Her tiny engine delivers brutal shocks to it. Then, when choppy water lifts her stern into the air, the propeller revs up wildly. And big boat or small, when a propeller hits a piece of driftwood—it's trouble.

Like so many of her bigger sisters, *Polaris* was originally equipped with an ordinary metal shaft. And also like so many of her bigger sisters, she used to bend up her shafts. They just couldn't take it.

That's when Polaris' owner equipped her with a Monel* nickel-copper alloy shaft. It's probably the world's smallest . . . just over 4¼ inches long, only ⅛ inch in diameter. It's extra-strong—withstands engine torque. Extra-stiff—shrugs off whip. Extra-hard—stays smoother longer. And, highly corrosion-resisting.

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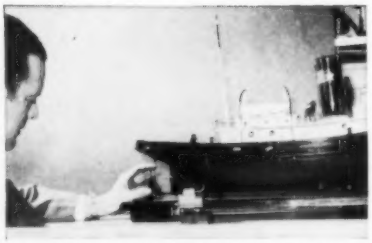
Do you have a metal problem? One where corrosion, abrasion, high or low temperatures, stress or fatigue is causing you trouble? Let's talk it over. There's a very good chance one of the Inco Nickel Alloys may be able to give you the model performance *you've* been looking for. Why not set up a date to discuss it.



Owner-builder H. H. Larkin, Jr. indicates Monel shaft on *Polaris*. When the makers of Veco Products Corp. Kits heard of Mr. Larkin's experience, they switched to Monel alloy for all their shafts.

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So writes one reader. Of course we're pleased—for two reasons. He likes PE. And he has perceived what we're trying to do. To us, engineers are not slide-rules or computers, but people, and with wide interests. So we're trying to provide brainfood for the engineer as a whole man.

coming next week

the DESIGN issue for July 6

FEATURING

- **Friction drive—but no rubber rollers**
  Floating idlers are spring-loaded to give proper pressure between shafts.

- **Stresses in a pressure-vessel head**
  Easier method puts all strain gages outside where you can see them.

- **4 ways to stop a motor**
  Comparison of methods ranging from mechanical to capacitor braking.

- **Experiments you can depend on**
  This way sets up performance tests that give statistical certainty.

- **Vinyl coating methods for metal**
  How to choose among—solution, plastisol, fluidized bed, film laminating.

- **12 clamps for flexible hose**
  An illustrated roundup.

Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news issue

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R and D Research and Development news issue

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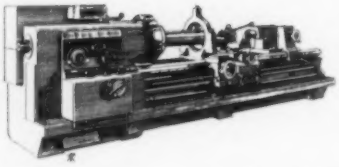

● **Industrial designers** (p 34) were shocked last year when the French branch of GM donated refrigerators to ten famous French artists for exterior decoration (PE.–Nov. 3, '58, p 2). These ten refrigerators were recently sold at a charity auction. One, by artist Bernard Buffet, went for $2,000. The purchaser sawed off the sides, selling one to a gallery as "painting on metal by Buffet." The painter went to court, claiming that the side was part of an indivisible whole. And to make matters worse, says Buffet, "There isn't even my signature on the thing."

● **New York commuters** no longer feel indignant when they read about proposed hikes in the New Haven and NY Central Railroad fares. By now they're resigned to their fate. We recently overheard one commuter claim that even with higher fares, the suburbanite is doing all right. "Sure we're paying more, but the trains, keep getting in later. We're spending more time on the trains than we did before." Wonder if the commuters aboard those blue-sky Japanese jet trains (p 26) will have time to finish their saki?

● **While old retired soldiers are fading away,** retired executives are being returned to the business field as temporary consultants. The Westover Corp, Milwaukee, "rents" experience by asking "Why pay for a high-priced permanent employee to do one specific job when you can 'rent' a man who has spent his life working in your field?" Be it a design problem, an organizational problem, or what have you, retired executives are being put back in harness. There's enough waste today; it's refreshing to see a group salvage talent that has been put aside by age or a cold retirement policy.

ABP June 29, 1959

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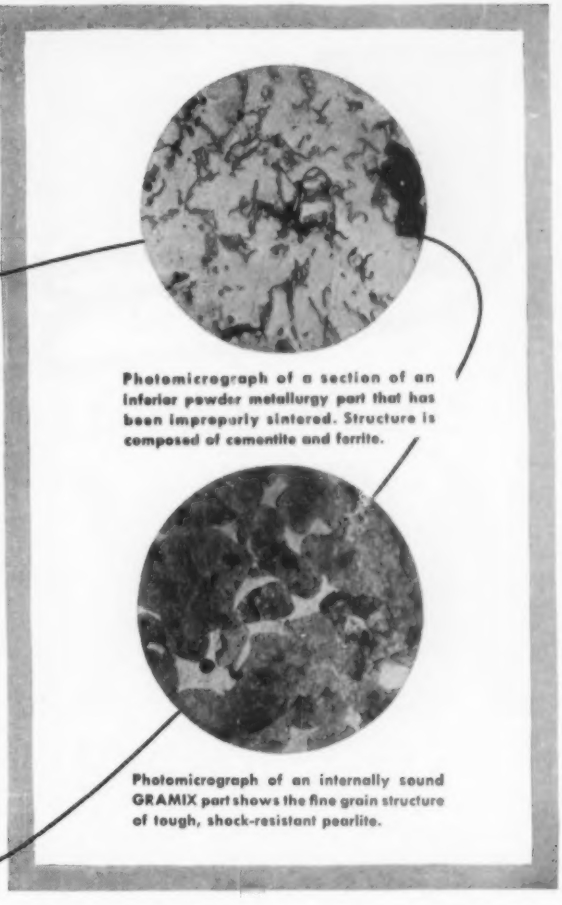

Photomicrograph of a section of an inferior powder metallurgy part that has been improperly sintered. Structure is composed of cementite and ferrite.

Photomicrograph of an internally sound GRAMIX part shows the fine grain structure of tough, shock-resistant pearlite.

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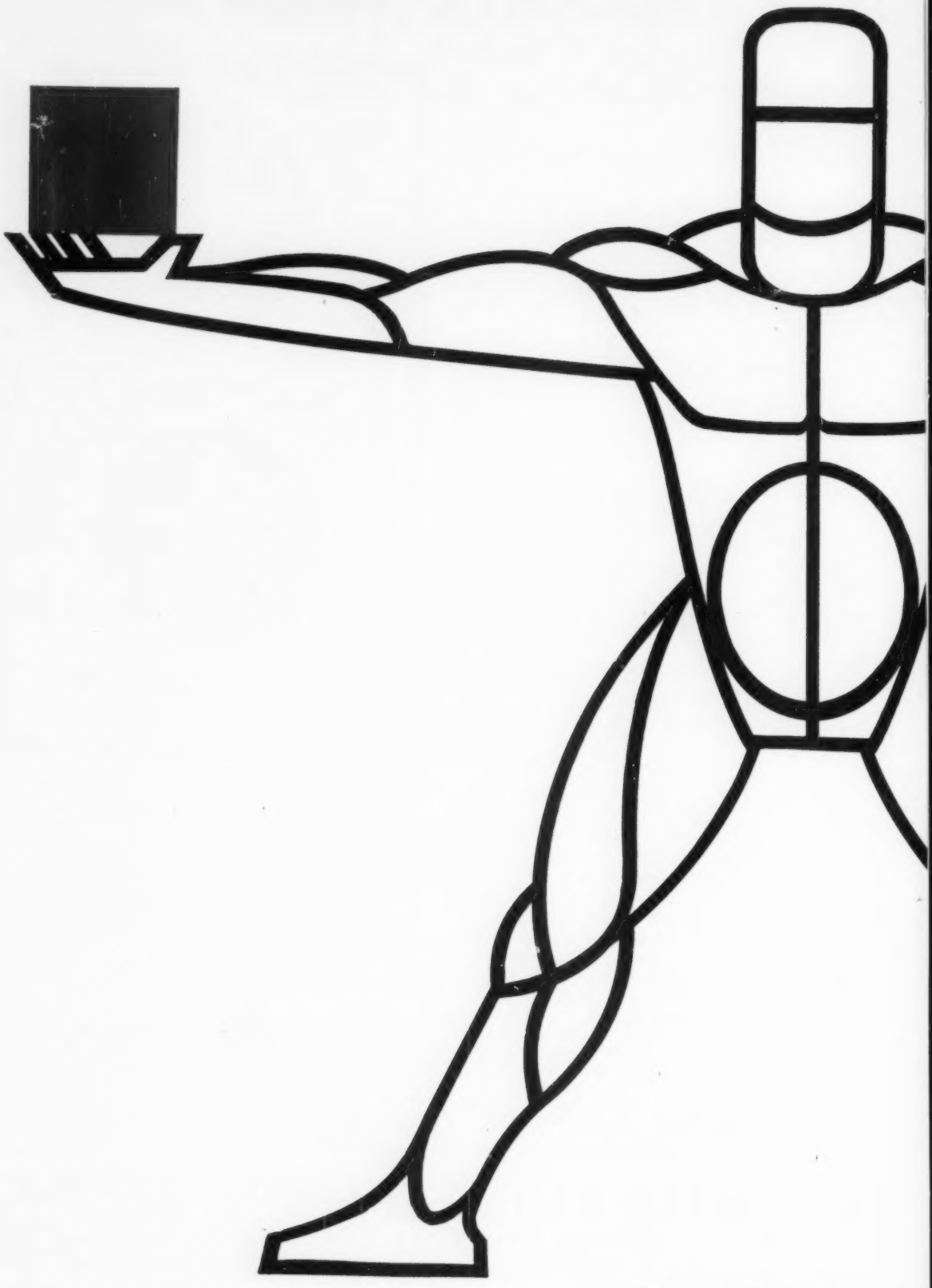

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DEVELOPMENTS TO WATCH...

American

3200-cps electrical systems may replace 400-cps . . .

. . . in missiles, Sundstrand Turbo engineers predict. They cite two reasons:

- The highest alternator speed (2 pole) for 400-cps is 24,000 rpm, requiring step-down gears for high-speed turbines, or a shift to dc.
- Weight can be cut as frequency is increased (not in direct ratio), so a 3200-cycle unit can weigh about half what a 400-cycle unit does.

Various other frequencies are in the experimental stage, including 1600 and 4000, but 3200 provides good conditions with practically unlimited turbine speeds to 192,000 rpm.

Foamed silicon carbide is now ready for engineering evaluation . . .

. . . says Carborundum's R & D Div, Niagara Falls. This is self-bonded, open-celled material that can be fabricated into shapes or used for coating or laminating. In low-density form (16 to 18 lb/cu ft) it offers unusually low thermal conductivity for a silicon carbide material—about 5 btu/in./ft²/hr/F at 800 F. Tensile strength is not high (30 to 70 psi at room temperature); but in higher densities (30 to 35 lb/cu ft), the material will support a load of about 800 psi.

Like the material from which it is made, the foam is said to show excellent chemical, abrasion, and heat resistance.

Present pilot production is limited to two forms —one low and one high density—in sizes to about 13 in. dia and 20 in. length.

More new standards for rubbery materials . . .

. . . are being readied by a joint SAE-ASTM technical committee. Under study now is a "complete reorganization" of cellular elastomer testing and nomenclature, and a master rubber specification covering 220 grades of rubber.

The cellular elastomer standard will deal separately with the rubbers, vinyls, and urethanes. Committee members say the three types "should not be lumped together in any nomenclature system," and should not be tested by the same methods.

Also planned by the committee: development of a test for stress relaxation of elastomers.

Glass-fiber tires may at long last . . .

. . . be close to commercialization, C. A. Litzler, industry consultant, told the ASME.

After nearly two decades of research, he said, "there is the apparent possibility that technical problems are reasonably near a practical solution."

Primary problems—now as 20 years ago—are adhesion of the glass to the rubber, and self-abrasion of the fibers.

Recent efforts to solve both problems involve woven glass cords in place of the previously used fabrics, a different cord end-count and a silastic rubber treatment.

Other new developments in tire reinforcement, he noted, include: all-polyurethane tires, using polyurethane fibers for reinforcement as well as solid polyurethanes for carcass and tread; polypropylene fibers; and a new urea-polyamide material, Urylon, developed in Japan (*PE—Jan.* 13 '58, p 8).

Wire-reinforced tires, incidentally, already widely used in Europe, are now making excellent progress here; with both two-ply and four-ply types commercially available for trucks and buses. The wire tire shown at right, though, is a little different. It's the latest thing for space flight. —ARG

Wire tire, developed to meet the 1000-F temperature requirements of space flight landings, takes its cue from the familiar wire brush. It's blowout-proof, of course; and, says Goodyear, shows load deflection characteristics very similar to those of conventional pneumatic units.

DEVELOPMENTS TO WATCH...

World-wide

New-type farm plow that requires less pulling power . . .

. . . and does a better job is claimed by Soviet engineers. It uses a combination oscillation-and-shearing system which is said to reduce the tractor pull needed for a 5-plow unit by 35 to 40% and increase the depth of cut 20 to 30% at the same time.

For the prototype unit, the design engineers (staff members of the Technological Research Institue for Tractors and Agricultural Machinery) simply borrowed a vibrator from a cement-mixer and mounted it vertically on the beam that carries the plowshare. However, they caution, much better results are achieved with a specially designed pair of vibrators mounted in such a way that the lower end of one is at a slight angle to the direction of pull, and the other at a slight angle to the transverse axis. This equalizes side-thrust. With units so mounted, and a vibrating frequency of 10,000 to 14,000 cpm, the Russians say it is even possible to plow in winter when the ground is frozen, with a furrow depth of more than a foot.

Better soldered joints . . .

. . . particularly in mechanized hot-dip soldering systems (for printed circuits, for instance) are promised by a new formula for resin soldering fluxes, developed in England by Shell Chemical Co Ltd. Tin Research Institute reports the formula substitutes high-boiling polyethylene glycols for the commonly used ethyl alcohol. The glycols apparently have no deleterious effect on the solder or the joint, are much safer to use, reduce "the excessive pickup of resin which occurs as alcohol solvents evaporate," and do not catch fire even when placed on molten solder at well above 500 F.

Transistorized circuit-breaker . . .

. . . developed by Centre d'Etudes et Recherces de Charbonnages de France aims to overcome the limitations of amperometric systems in detecting short circuits. It's specifically designed for use on mining equipment where explosion and fire hazards are severe. But, says the Centre, it may be used effectively for many electric machinery installations.

It consists of two major elements: An electronic generator creates a current of 5000 cps that is fed into the electrical system to be controlled; and a detector is set to cut out the system automatically when a short is detected.

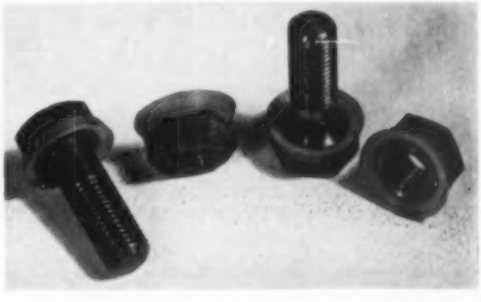
When the plugs of the system-operating circuit are attached to the appropriate condensers on the detector, the French say, intensity of the imposed current will be very weak and vary little whether the electric motors are running or not.

When a short circuit occurs, ohmic resistance of the network is lowered, intensity of the current is stepped up, and the detector swings into action to close off the faulty sector of the system. The device can be made so sensitive that it can detect a fault in resistance of 5 ohms and cut the current within 5 millisec.

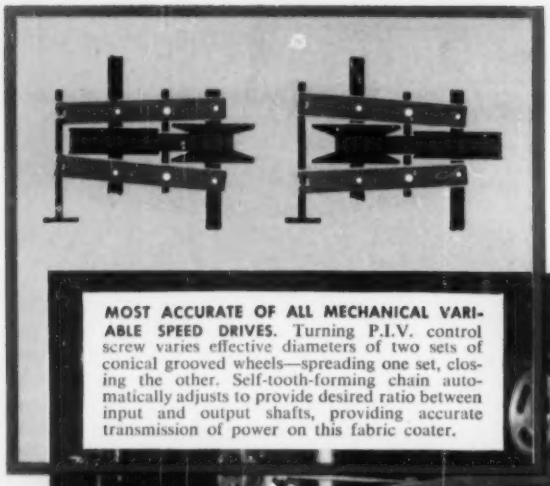
Merlin-Gerin of Grenoble, France, will produce it commercially.

Fasteners with a plastic "skirt" . . .

. . . for gripping, sealing, and insulation have been developed by Magnesium Elecktron Ltd, PO Box 6, Lumm's Lane, Clifton Junction, Swinton, Manchester, Eng. They're not yet in commercial production; but are being made available in limited quantities for engineering evaluation in 5 sizes from ¼ to ½ in. with head diameters of 0.540 to 0.970 and shaft diameters 0.4 to 0.7. At present, "skirts" are nylon; but other plastics may be used. —ARG



Skirted nuts and bolts developed in England will be made in a variety of materials. They're called Galvanuts.



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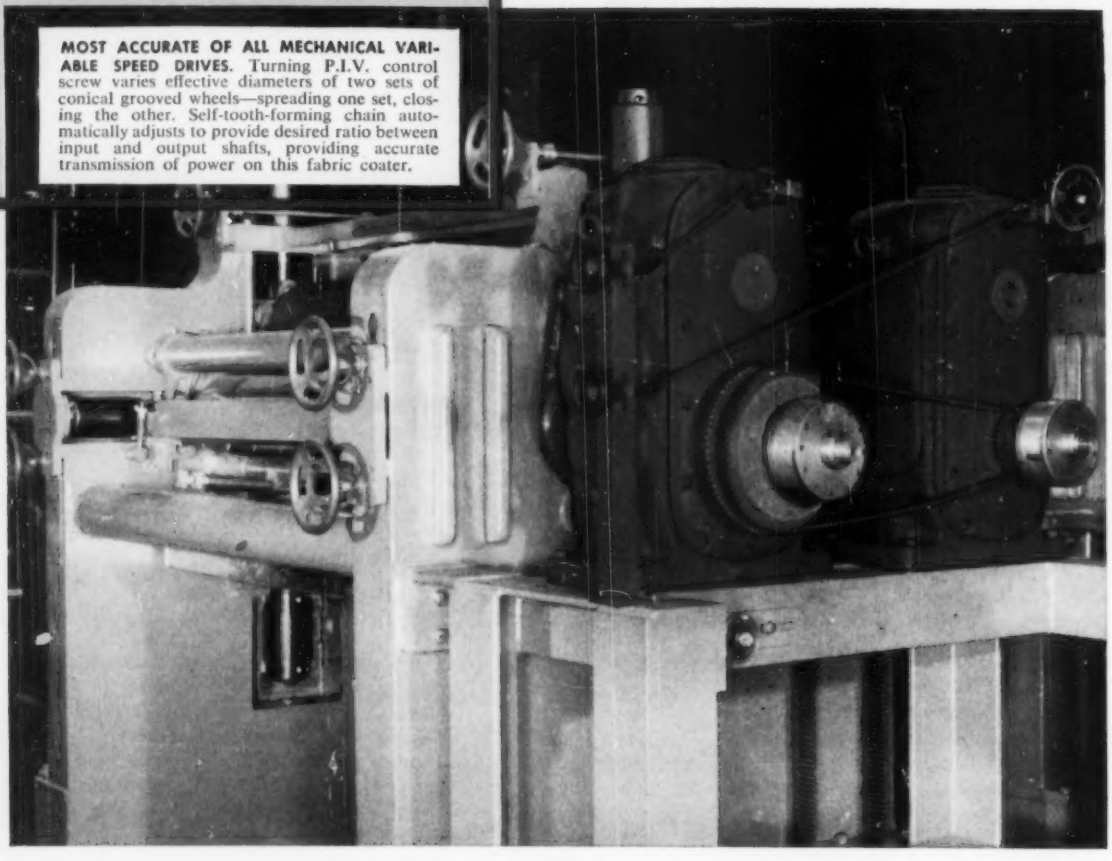

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DEVELOPMENTS TO WATCH...

Washington

Squabbling over rival Bomarc . . .

and Nike-Hercules anti-aircraft missiles is hit by the Pentagon's new "master plan."

Decision is to continue production of the two missiles but at a greatly reduced rate for both. The Pentagon proposes to cut scheduled spending for the rival Air Force Bomarc and Army Nike-Hercules by a total of some $1.5-billion over the next five years. This is believed to be a reduction of about 25% in scheduled spending for production and base construction for the two missiles.

At the same time, the Pentagon is now prepared to speed R & D on the Army's Nike-Zeus anti-ICBM system. The new plan adds $157-million to the initial $300-million Zeus budget set for the new year. In effect, the administration will allow the Army to spend the extra funds the House has already voted for the project.

But the outlook for the Bomarc and Nike-Hercules programs is still very much in doubt. Congress has yet to vote the final defense appropriation bill. There's considerable congressional dismay over the intention to keep going with Nike-Hercules, and it's possible the lawmakers will yet make even more severe cuts in budgets for the rival missiles.

American Nobel Prize scientists . . .

feel almost unanimously that government secrecy is slowing down scientific development. Sixteen of the 17 scientists questioned by the Senate Constitutional Rights Subcommittee said restrictions on knowledge gained in basic research is not only foolish but useless. For the most part they agreed, however, that in developmental work some classification is necessary in the interest of national security. The lone dissenter, Boston physician William P Murphy, said hindrances are actually minimal and most of the complaints come from a few physicists who are "influenced by a more radical group."

The scientists' views were sought as a preliminary step in the subcommittee's investigation of secrecy.

10-year atomic reactor design plan . . .

is being drawn up by the government for the first time. The master plan was disclosed recently by the Atomic Energy Commission. First draft of the plan is slated to be completed this September at AEC, with the final proposal to be made public by the time Congress convenes next January.

The idea is to weed out less promising design ideas and concentrate on those that hold promise of providing: (1) economic power for the US in 10 years and (2) economic power for some areas abroad in 5 years. There has long been general agreement on these objectives, but the new AEC move is the most vigorous step yet taken in this direction.

All told, the commission or its labs have done analysis or development work on more than 100 different reactor ideas. About a dozen are still active.

No missile mail . . .

route is in the offing as a consequence of Post Office's recent mail delivery via an air-breathing Regulus missile (pilotless plane) from a sub at sea to a Florida naval station. The PO got publicity but the fact is that new jets fly as fast as the Regulus and no serious work is being done by the government on either mail- or cargo-carrying missiles.

Officials talked enthusiastically about the missile becoming as commonplace a mail carrier as the plane and train—used to speed delivery overseas, to remote areas, and between major cities on high priority. Skeptics say this makes pleasant summer reading.

An electrodialysis method . . .

for converting sea water on shipboard that is more efficient than distillation systems is claimed by the Soviets. The Soviets say their converter reduces costs for repairs and cleaning boilers. It is made of viniplast, polychlorovinyl plastic and chemically resistant rubber. American experts doubt that the system is superior to distillation unless the Russians have found cheap, efficient membranes. And they are generally believed to be behind the US in saline water development.

WHAT'S HAPPENING IN... Science

Magnetogenics rates support

A plea for increased attention to magnetogenics, "the art of generating high magnetic fields," comes from H. H. Kolm and Simon Foner of MIT's Lincoln Laboratory. They believe it could pay big dividends in advancing cryogenic research (by helping to create and maintain ultralow temperatures—(*PE*—Aug 4 '58 p 24) and studying such solid-state phenomena as para- and anti-ferromagnetic resonance.

High magnetic fields have two major abilities: They can align magnetic dipoles; they can deflect moving charges. Both abilities can be applied not only in cryogenics; but also in the study of nuclear particles and in optical spectroscopy.

Magnetic fields up to about 30,000 gauss can be produced readily by using electric current to magnetize iron. Beyond this range, though, circulating current is needed. This requires enormous amounts of power, and all of it must be removed as heat. As Kolm and Foner point out, "an electromagnet enjoys the unique distinction of having zero efficiency."

The earliest effort at very high fields was by the Russian physicist Kapitza at Cambridge University in 1923. He obtained 500,000 gauss for several milliseconds by draining a battery of storage cells through a very small solenoid; and later had a good deal of success with a larger solenoid powered by the short-circuit current of a 2-megawatt ac generator.

Now, taking advantage of improvements in energy-storage capacitors and techniques of transient measurement, Lincoln Lab researchers believe that record can be breached and reproducible fields above 750 kilogauss can be attained. They're generating high magnetic fields by discharging a 3000-v condenser bank through small, helical solenoids of low inductance without the use of a transformer. The connection is established by a triggered spark gap in air.

In this type of operation, say Kolm and Foner, the energy dissipated during the pulse is small compared to the magnetic energy stored temporarily in the solenoid, so the resistance of the solenoid is of little importance. It thus becomes possible to use "materials of much higher strength and flow-resistance than copper." Lincoln Lab is now using helical coils machined out of a solid rod of beryllium copper, tempered, then compressed against mica separating washers; and has made, but not yet tested, a solid tungsten-carbide helix.

The lab is also testing new pulsing components and "flux concentrators" to reach for still higher levels.

Atom briefings . . .

International atomic energy developments, ranging from radiation research in Berlin to heavy water production in Egypt, will be covered in a new bulletin to be issued quarterly by the Public Information Div, International Atomic Energy Agency, Karntnerring 11, Vienna 1, Austria. The bulletin will have articles by leading scientists, and list conferences and exhibitions.

Atom explanations: How does a nuclear reaction differ from a chemical reaction? What is *half life*? Who discovered element 93? To answer these and related questions about atomic energy, the Public Education Office of the Savannah River AEC installation has prepared a 68-page offset-printed booklet, primarily designed for the general public; but still a good reference compendium. Single copies of *The New Force of Atomic Energy* are free of charge from Office of Public Relations, USAEC, PO Box A, Aiken, SC. —ARG

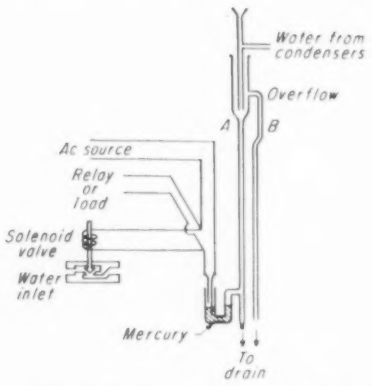
Safe turn-off

A water-operated electrical switch that can shut off water and power supplies in the lab in case of equipment or drain failure has been developed at the USDA Agricultural Research Center in Washington.

As E. W. Toepfer of USDA describes it, the unit consists of a solenoid valve, a relay, and a series of tubes through which water (or any other liquid) flows. Water from the potential trouble-cause (in this case, the condenser of a solvent-extractor), fills tube A, constricted at the bottom, and overflows into tube *B*.

Normally, both tubes are open to the drain; and, when A is filled with water, hydrostatic pressure causes the mercury in the U-tube at the bottom to rise in the open arm and close the electrical contact (iron alloy or platinum strips are used). When closed, the circuit opens the solenoid valve and permits the continuing flow of water.

If, however, the lines from the condenser become disconnected or clogged, and water fails to reach A, the mercury column shifts to the right, the contact opens, and the water and electric heaters are automatically shut off. To restart the device, A is manually primed—preventing accidental restarting.



Hydrostatic switch, built from standard components, provides for rapid, safe shutdowns when lab equipment fails.

WHAT'S HAPPENING IN... Materials

Paper-thin steel gets structural jobs

High-strength cylinders can be produced from steel less than 0.01 in. thick, design engineers at several companies are proving.

Ryan Aeronautical, for instance, is making rocket cylinders by wrapping strips of thin stainless steel around a mandrel, and achieving ultimate tensile strengths (under static stress) in excess of 300,000 psi. (*PE*—June 8, p 37) Says Ryan proudly: "Industry has had difficulty reaching 240,000 psi in a single thickness of sheet either spun or rolled and welded to form a solid-wall cylinder. In the Ryan technique, 0.008-in. strip is used, tack-welded after wrapping and then spot-welded straight through. A new spot-welding technique is one key to success, Ryan says.

Meanwhile, Convair is making propellant tanks of stainless steel "thinner than a dime." Here single sheets with reinforcing bands are used, the heaviest gage being less than 0.040; but pressurization of the propellant inside the tank serves to support the structure and keep it from indenting "even when struck heavy blows with a hammer."

Spray-on vinyls challenge preclad sheet

While a good many companies are changing from sprayed paints to preclad vinyl-metal laminates to improve product appearance and simplify operations, at least one company is moving in the opposite direction.

Fisher Body engineers are now specifying textured steel (*PE*—Mar 17 '58, p 73), coated with spray-on vinyl dispersions for such parts as interior trim panels on which the clad metal has been used. Advantages of this system, they say, are that commercially available textured metal can be used, and it can be formed and welded without loss of texture—and before the coating is applied. Thus, there need be no uncoated cut edges. Other advantages: colors and quantities do not have to be scheduled from the steel source, much less care is required in handling the metal before and during forming, and scrap metal can be sold at the usual rates.

Using a vinyl dispersion supplied by Kaybar Inc, Birmingham, Mich, Fisher Body engineers say they have been able to obtain smooth, lustrous coatings 3 to 12 mils in thickness. Cure time is about 15 min. at 350 F.

Nylon 11 to make its debut

Excellent electrical properties and good dimensional stability are said to characterize a nylon 11, now to be available from Belding Corticelli Industries. Now made in France (by Organico SA), but slated for domestic production, this resin is said to have the lowest moisture absorption of any nylon produced commercially, and a broad forming-temperature range which permits production of unusually large pieces.

Dielectric strength (short-term) ranges from 340 to 725 volts/mil; volume resistivity from 0.1 x 10^{15} to 2 x 10^{15} ohms/cm; power factor, 0.03 to 0.04 at 60 cycles; and dielectric constant (1000 cycles) 3.3 to 4.7.

Belding Corticelli says the resins will be "competitively priced."

(Note: for information on bearings coated with nylon 11, see *PE*—May 25, p 60.)

Scarce materials: almost none left

Of the 74 materials now on the stockpile list of strategic and critical materials, at least the basic objectives have been met for 63, says the Office of Civil & Defense Mobilization; and, for two more, enough is on hand in other government-owned inventories to meet the basic figure. Thus, only 9 can be said to be "scarce"; and two of these aren't really metals—they're diamond dies and jewel bearings. What's left? Amosite asbestos, metal grade bauxite, abaca and sisal cordage fibers, chemical grade manganese ore, muscovite mica block and film, selenium, and crude silicon carbide.

OCDM is continuing to study and revise stockpile objectives; but, if anything, it looks as though the next list will be even smaller.

briefs . . .

Foamed polyvinyl butyral is another new entry in the expanded-plastics field. It's a closed-cell rigid material, developed by E. D. Geoffrey Garth & Associates, 382 Springfield Ave, Summit, NJ. Garth says it can be softened by heat and formed to shape without impairing its cellular structure. Possible applications: insulation, both thermal and electrical.

Better-quality stock shapes of nylon, TFE fluorocarbons, and other opaque plastics, are promised by Polymer Corp, as an ultrasonic testing system for these materials is installed. The company is applying the system on a production-line basis, says it not only helps guarantee product quality, but also lowers inspection costs.

Molybdenum's properties and those of its 0.5 Ti alloy are detailed in a survey report by Battelle Memorial Institute for the Defense Metals Information Center. It's a valuable compendium of room-temperature and elevated-temperature data, #14 in DMIC's current memorandum series, available to defense contractors and others on special request.

Change in generic name for polyvinyl alcohol fibers is announced by Federal Trade Commission as it issues final rules for administration of new Textile Fiber Products Identification Act. PVA fibers, originally called "alvyne," will now be known as *vinal* fibers, and must be so labeled wherever used. (For earlier report on the new names and rules, see *PE*—May 18, p 14.)

—ARG

THE 3M CHEMICAL DIVISION ANNOUNCES

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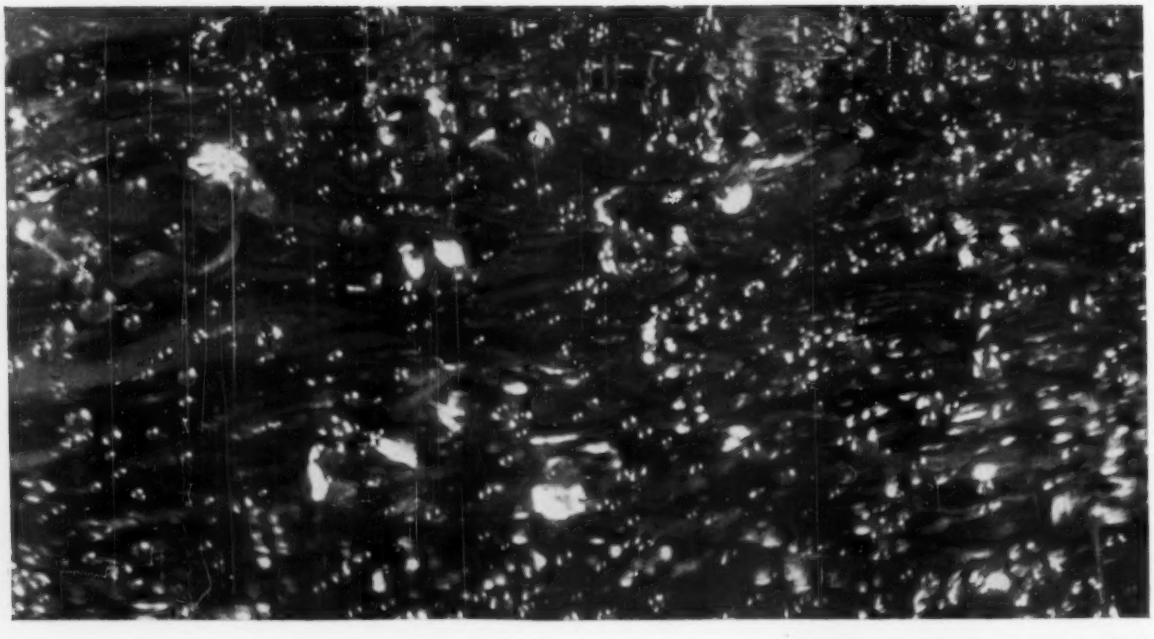

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APPLICATIONS—FLUOREL Elastomer is now either in use or under evaluation in the missiles and aircraft, automotive and chemical processing industries for oil seals, "O" rings and gaskets. Tests and field reports are encouraging and suggest other applications as yet untried, such as fire walls, air ducts, fuel cells, fuel and hydraulic hose, diaphragms and tank linings.

For complete data, at our expense, write: 3M, Chemical Division, Dept. KAS-69, St. Paul 6, Minnesota.

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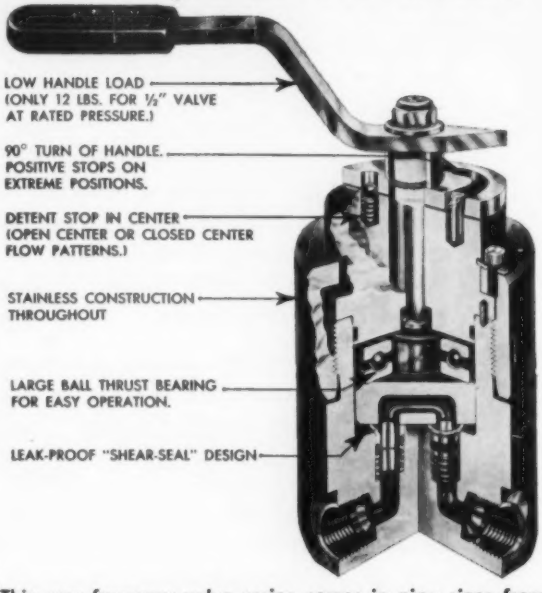
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Product Engineering HORIZONS

June 29, 1959

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We follow somewhat the same practice in our donations, our memberships, our support of causes. We assist endless well-meaning but misguided—or even self-perpetuating or dishonest—charities. We all seem to have missionary pocketbooks. We're joiners, whether or not the joining is worth while. We lend our names to endless tempests in, or over, teapots. And often, in the process, we miss the chance to do some real giving from the heart.

In recent weeks, I have had occasion to study at first hand two rather unusual organizations, one local, one national, that may illustrate my point. Both are primarily concerned with engineering as a profession, and both are in need of sponsorship and support. Neither gets enough, because it is not a flamboyant publicity-seeker or fund-driver. Both deal with the next generation of engineers and technicians; both seek to help the youngster with good potential rather than to haul at the mediocre or rescue the bad.

The first of these is JETS, the Junior Engineering Technical Society, established some nine years ago by Michigan State University, but with most of its growth in the last three years. It seeks to set up and provide materials for the operation of high-school engineering clubs similar to the older and more-familiar science clubs. It now sponsors some 500 chapters in 40 states, of whose members 91% go to college, 64% as engineers. It is obviously ready for national organization and expansion. All it needs is sponsorship. But whence will the sponsorship come? In our profusion of engineering societies, there is no one over-all one that has the strength or the funds to do it. Foundations show little interest. It looks as if the job will have to be done by industry or engineers through donations. Some major corporations have already undertaken the job of assistance—corporations that understand that engineering must start with interest, and that the high-school level is the place to start.

The other organization is the Delaware Valley Design & Drafting Council, which I mentioned previously (PE—Mar 30 '59, p 41). It has recently held its second awards dinner, at which certificates were presented to high-school teachers who completed a 14-week seminar on drafting practice, as well as statuettes to high-school students who won them for excellence in drafting. Projects of the latter were shown at the Delaware Valley Industrial Arts Fair. The objective of the DVDDC is to improve and coordinate the teaching of drafting in its area. Thus far, the 3-year program has been supported largely by donations of time by engineers and materials by local industry. Word of the work is spreading, however, so that local operation is becoming difficult and a number of other areas are asking for details. This suggests nationalization of this organization as well so high-school and institute drafting training everywhere can be coordinated. Industry is the direct beneficiary, and a relatively small local outlay, plus dedicated engineers to manage it, will do the job.

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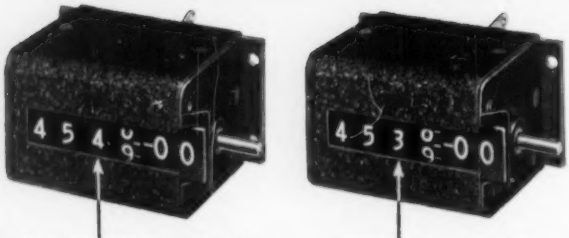

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HERE'S HOW IT WORKS

The tables at the bottom of the page compare two different methods for choosing new products—Profit and Cost chooses those projects which give largest z; Dynamic Payoff chooses those projects which give largest z'. In both cases the projects are chosen from those available for that year (shown in the big table) or from projects started the previous year. Company strategy requires that only three projects can be developed in any one year but any number can be in production. Also that projects not started in the year available become useless in future years. Old projects are reevaluated each year (computing a new value for t) and compete with the five new projects available for that next year.

Hypothetical projects were generated using Monte Carlo methods. Average times, T' and t', (for computing z') are 3 years. Totals show that projects chosen using Dynamic Payoff formula were more profitable for the company by $2,630.

Hypothetical Projects — Computations

Year	No.	P	T	c	t	pT	ct	z	T_1	t_1	pT_1	ct_1	z'
1	1	450	4	120	4	1,800	480	**1,320**	3	3	1,350	360	**990**
	2	350	3	210	2	1,050	420	**630**	4	2	1,440	420	**1,020**
	3	500	3	90	3	1,500	270	**1,230**	3	3	1,500	270	**1,230**
	4	350	3	120	3	1,050	360	**690**	3	3	1,050	360	**690**
	5	550	3	90	4	1,650	360	**1,290**	2	4	1,100	360	**740**
2	6	450	4	180	5	1,800	900	**900**	2	4	900	720	**180**
	7	550	4	120	2	2,200	240	**1,960**	5	1	2,750	120	**2,630**
	8	500	3	90	2	1,500	180	**1,320**	4	2	2,000	180	**1,820**
	9	450	2	210	3	900	630	**270**	2	4	900	840	**60**
	10	400	3	120	1	1,200	120	**1,080**	5	1	2,000	120	**1,880**
3	11	500	4	120	4	2,000	480	**1,520**	3	3	1,500	360	**1,140**
	12	350	5	90	1	1,750	90	**1,660**	7	−1	2,450	−90	**2,540**
	13	350	5	120	4	1,750	480	**1,270**	4	2	1,400	240	**1,160**
	14	400	3	90	3	1,200	270	**930**	3	3	1,200	270	**930**
	15	400	3	90	2	1,200	180	**1,020**	4	2	1,600	180	**1,420**
4	16	550	3	120	4	1,650	480	**1,170**	2	4	1,100	480	**620**
	17	400	4	120	1	1,600	120	**1,480**	6	0	2,400	0	**2,400**
	18	450	2	210	2	900	420	**480**	3	3	1,350	630	**720**
	19	450	4	150	3	1,800	450	**1,350**	4	2	1,800	300	**1,500**
	20	550	5	150	3	2,750	450	**2,300**	5	1	2,750	150	**2,600**

Profit and Cost Method

Year	Project	z	Cost per year	Profit per year	Comments
1	1	**1,320**	120		
	5	**1,290**	90		
	3	**1,230**	90		
2	1	**1,440**	120		
	5	**1,380**	90		
	3	**1,320**			Cancelled
	7	**1,960**	120		
3	1	**1,560**	120		
	5	**1,470**			Cancelled
	7	**2,080**	120		Development complete
	12	**1,660**	90		Development complete
4	1	**1,680**	120		Development complete
	20	**2,300**	150		
	17	**1,480**	120		Development complete
	7			500	
	12			350	
5–10	1			1,800	
	20		300	2,200	Complete 6th year
	17			1,600	
	7			1,650	
	12			1,400	
Totals			$1,650	$9,200	
				−1,650	
			Net	Profit = $7,550	

Dynamic Payoff Method

Year	Project	z'	Cost per year	Profit per year	Comments
1	1	**990**	120		
	2	**1,020**	210		
	3	**1,230**	90		
2	1	**1,560**			Cancelled
	2	**1,540**			Cancelled
	3	**1,820**	90		
	7	**2,630**	120		
	10	**1,880**	120		Development complete
3	3	**2,410**	90		Development complete
	7	**3,300**	120		Development complete
	12	**2,540**	90		Development complete
	10			400	
4	17	**2,400**	120		Development complete
	19	**1,500**	150		
	20	**2,600**	150		
	3			500	
	7			550	
	10			400	
	12			350	
5–10	3			1,000	
	7			1,650	
	10			400	
	12			1,400	
	17			1,600	
	19		300	1,800	Development complete, 6th yr
	20		300	2,200	Development complete, 6th yr
Totals			$2,070	$12,250	
				−2,070	
			Net Profit	$10,180	

of the four parameters of the basic equation on page 21.

While this equation is a basic and complete expression of payoff for one product, it has one very serious shortcoming. It does not include a provision for the economic value of time. That is, two projects which have equal payoff z will be considered equally desirable even though the development time, t, or product life, T, may not be the same for both. This is not realistic. Near money is more valuable than distant money or, stating it another way, the dollar that is earned today is worth more than the dollar that is earned tomorrow because today's dollar will increase in value by the interest it will return as an investment.

The long and short of it

So the basic equation must be modified to maximize both long-range and short-range profits. Getting both is not necessarily incompatible. From the short-range viewpoint, the equation must be adjusted to penalize those projects which have a longer than average development item. And from the long-range point of view, the equation must be modified to reward those projects with a longer than average life because a project with a long life will spread profit-taking out over several years, saving the cost and necessity of developing a new project to cover those years.

Thus, a new equation can be derived which includes correction factors based on average development time, t', and average market life, T'.

$$z' = p\,[T + T'\,(1 - t/t')] - c\,[t + t'\,(1 - T/T')]$$

Notice that when both times are average (that is, when $t = t'$ and $T = T'$) the equation reduces to the original basic relationship.

Defining two new variables,

$$T_1 = T + T'\,(1 - t/t')$$
$$\text{and } t_1 = t + t'\,(1 - T/T')$$

the equation reduces to

$$z' = pT_1 - c\,t_1$$

This modified equation reflects the exact relationship between the parameters for the best selection strategy of future projects. The average times, t' and T', depend upon the class or type of project. But the existence of such figures is generally recognized in each industry. (For example, recent figures indicate 10 years' development time for a guided missile, 5 years for a new electrical appliance, 3 years for a major modification of an automobile).

Estimating the parameters

Development time is estimated primarily on the basis of how long it will take to lick the technical problems and produce a set of working drawings. But the estimator must also take into account possible delays: backlogs of uncompleted work, insufficient funds or delays in making funds available, demands on time and money arriving at random from outside agencies or internal organizations, necessity for rejustification through formal or informal reports . . . and many others. Market "ripeness" can also have an effect on development time. Knowledge of customer needs and the probability of competitive developments are the most important factors to be considered here.

The formula should be used to reevaluate programs periodically. Therefore, t must always be defined as the remaining years required for completion. Thus, a product is always evaluated on the basis of its future worth to the company, regardless of how much money has been spent on it in the past. In some cases, it may be to the company's advantage to scrap a project on which development money has already been spent in favor of a product that has a higher payoff.

Development costs will depend to a certain extent on development time. The remarks concerning time apply equally to cost. But within limits it is possible to play one off against the other—a decrease in time will require an increase in manpower or facilities and an increase in cost. However, there appears to be an optimum size for the project group, beyond which additional manpower has little effect in decreasing development time.

Manufacturing cost or market price of the completed product have very little to do with development cost. It depends, instead, on the newness of the proposed product and the experience of the design and development team in whatever field is involved. Best estimates can be made when there is a history of costs for similar projects to draw from. Companies commonly make such estimates in terms of man-years and then convert these figures to dollars. Costs of a man-year can usually be predicted with considerable accuracy for a given type of industry and so such conversions can be made quite easily.

Product life, T (also called market life), is the useful life of the product—"useful" in that the product is still desired by the customer and still profitable for the manufacturer. The typical curve for net profit vs years shows a rapid buildup in the first few years followed by a slow decline because of technological and competitive obsolescence. What point on this curve should be chosen as the virtual end of product life? There are a number of criteria; some companies use the 80 per effectiveness cutoff—a measure of technological decay. Others consider that product life has ended when return on investment has dropped to 10%. Whichever point is chosen, the criteria should be consistent for all products under consideration so that z's can be compared directly.

Net profit per year is, of course, simply gross profit less total cost. Total cost includes all costs except those incurred during development: cost of production (including packaging), of marketing, maintenance, replacement, and malfunctions. Gross profit includes number sold multiplied by the selling price plus the scrap value of unsold items and capital equipment.

Selling price depends upon market strategy. At one extreme, there is the policy of skimming the cream off the market—at first the product is priced extremely high and when demand drops at that price, it is lowered to skim the cream off the next market layer. At the other extreme, is the policy of blitzkrieg penetration. Here, the objective is to establish a solid long-term competitive position by pricing low to capture a large share of the market in the shortest possible time. ■

How to hang 40 tons of beer from the ceiling

These vessels, called "Dual-Paraboloid" fermentation tanks, are shaped like giant toasters. They're 21 feet long, 13 feet high, and 12½ feet at the widest point. Solar Chicago, Division of U.S. Industries, Inc., makes them from 13-gage Type 304 Stainless Steel sheets that are curved and welded together to form a cornerless interior. 1″ x 4″ ribs are welded around the outside of the tank and all welds are ground to a uniform finish.

Each of the tanks will hold 450 barrels, more than 40 tons, yet the tanks themselves are so light that the entire load will be hung from the ceilings of modern breweries. The formability, weldability and strength of Stainless Steel permitted this unique design. Because the Stainless is so strong, they could use thinner, *lighter* walls.

These tanks weigh 5 tons and they will replace old, square-cornered ones that weighed about *20* tons. Breweries are happy . . . the cornerless, Stainless tanks are easier to keep clean, and because they're off the floor, the plant itself stays cleaner. And because they're Stainless Steel, they will probably never have to be replaced.

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USS

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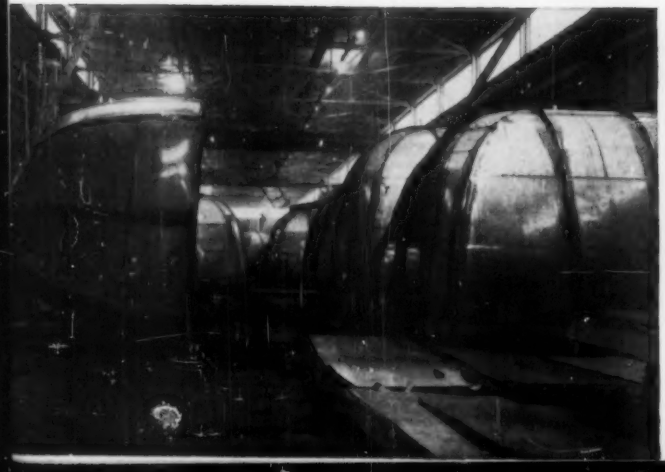
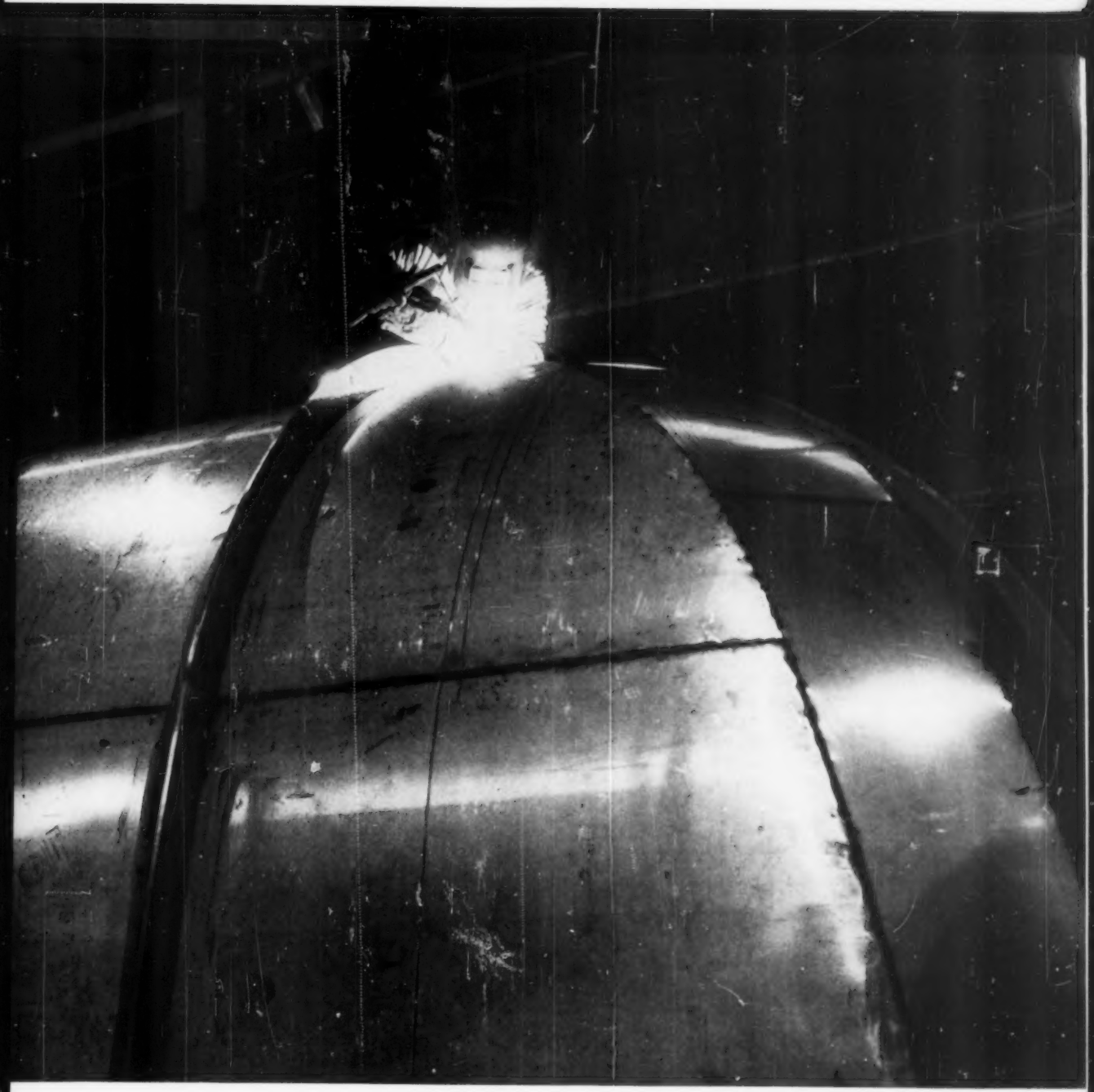
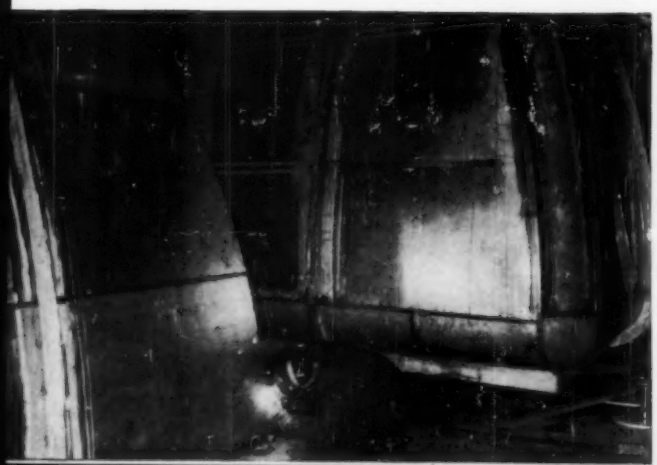
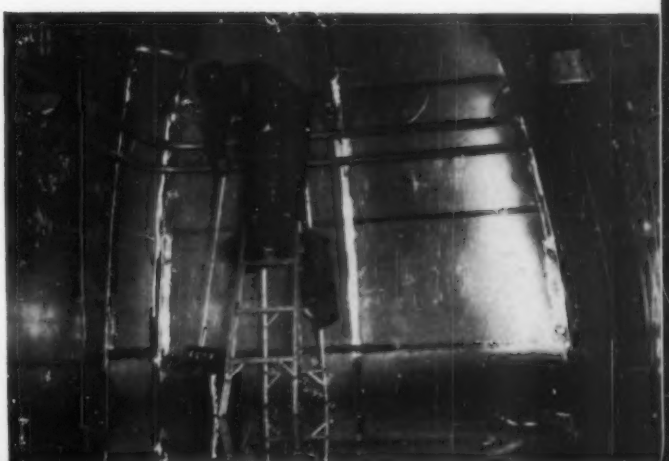
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel









Rocket-like Train Borrows Ideas From Our Missiles

TOKYO—An aeronautical expert is developing a new kind of vehicle that he believes could make the 345-mile run between Tokyo and Osaka in 45 minutes—at a speed of about Mach 0.6. Dr. Kyunojo Ozawa, head of the faculty of science and technology at Meijo Univ, Nagoya, borrows heavily from his earlier experience as an aircraft and guided-missile designer for this new vehicle.

He describes it as a superspeed sliding train—the rocket-shaped compartment powered by turbo-jet engines, would slide across country through roller guides installed at regular intervals of about ¼ the length of the vehicle.

The full size design calls for a flexible compartment 690 ft long and 16½ ft dia, providing space for 1000 passengers. Guides will be spaced every 328 ft. Rollers on both top and bottom will be brought to speed before the vehicle arrives.

Trials with 1/100 scale model in 1958 convinced Dr. Ozawa that a real train could run up and down hills and around curves and he built the larger 1/20 scale model shown here, a 36-ft long, 9¾-in. dia and 240-lb vehicle of acrilic plastic. Trial runs were made this past April along a 660-ft course with 50 roller supports. Powered by a 700-lb thrust rocket that burned for 0.5 sec, speed was about 25 mph.

The design has drawn considerable interest in Japan where the land is mountainous, highways are expensive, farmlands scarce. Meanwhile, Japanese National Railways has just started construction of a superspeed rail line that will link Tokyo and Osaka in about 3 hours. The rolling stock here will reach max speed of 155 mph with average speed of 102 mph. ■

Report Automatic Circuit Testers Will Slash Airline Maintenance

BELMONT, CALIF.—Sparked by the advent of jetliners, automatic circuit testers, developed by California Technical Industries, are being used by US commercial airlines for maintenance purposes. Until now the automatic tester has been applied only by electronics manufacturers as a final assembly line check station.

Called Supertester Model 100, the tester plus an unskilled operator are said to be capable of replacing (1) a skilled man, (2) a vacuum tube voltmeter, (3) and a book of test specifications. The spec book is stored in a special adaptor which must be changed if a major switch of specs is desired. Small changes can be fed piecemeal into the adaptor. All testing connections and subsequent readings are made automatically—up to 400 in less than 20 min.

Automatic tester measures ac or dc voltage, impedance, resistance, continuity, leakage, gain or phase relationship. Capable of checking any electronic package within the aircraft, it operates on the fail-safe principle, rejecting via pre-coded number all circuits which do not meet pre-set tolerances.

Conventional means of repairing electronic components on airlines begin during flight. Pilot reports symptoms to electronic engineer on ground, who, after landing, pulls the suspected unit and replaces it. Later at the airline's central overhaul point, a skilled repairman with clips and a voltmeter goes over it circuit by circuit. Under this procedure, there is everpresent an element of uncertainty as to diagnosis; ie, testing that shows a unit is not faulty is just as lengthy and tedious as for a defective one.

With automatic equipment a suspected unit can be checked at any major airport with instantaneous report. An unskilled man, using the Supertester, can positively locate the erring circuit in the erring unit, replace the unit, and send back the bad one to a central repair point with specific instructions as to what repair to make. This leaves the skilled repair man free to do his job without having to test every one of possibly scores of circuits by hand.

Considered primarily a timesaver, the device may also make possible lower inventories of replacement parts. American Airlines, for example, bought only 74 automatic pilots for its 29 jetliners—AA figures that it takes about eight hours of a skilled man's

Overland travel at 460 mph . . .
is predicted for a "sonic sliding rocket" under development in Japan. Here is a 1/20 scale model in plastic positioned through two of the roller guides (spaced at intervals) which are expected to slide it across country.

time to check out all the circuits in an autopilot as compared to 20 minutes for the same job with the Supertester. As a result, they don't need as many spare autopilots to ensure uninterrupted service.

FUTURE APPLICATIONS

Next step in automatic testing, reports CTI, is developing a technique to test electronic equipment that is in position in the plane; probably, by means of a standardized test-jack built into the fuselage. This would save the minutes that it now takes to pull out and hook up modular units for test.

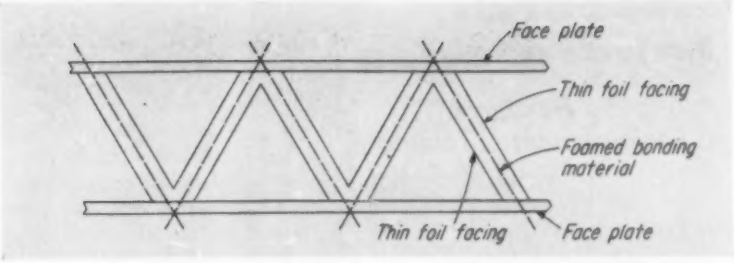
More and more electronic equipment is being used in modern aircraft. For example: on a World War II plane, the dollar value ratio of hardware to electronic equipment was usually 9-1. In present-day missiles the ratio is just about reversed, standing at about 15-85. Airliners rate between these extremes. ■

Pressed-metal Method Seeks Backer

CHICAGO—Powdered-metal parts of intricate shape may be forthcoming if Armour Research Foundation finds a sponsor for a new process it now has under development. Known as high-cyclic-rate-impact compaction, the process imposes a series of rapid blows (1000 to 2000 a minute) on die shapes rather than the intense steady pressure customary with conventional presses.

Because metal flow is improved and pressure uniformly distributed throughout the die by high-frequency impacts, shapes with undercuts, reentrant angles, threads and deep curves are possible, according to Armour. The process also removes present limitations to cross-sectional area.

The process, Armour believes, is immediately competitive on a cost basis with cold pressing and sintering for production of high-porosity parts such as filters, bearings and catalytic diffusers, and for ferrous machine parts where liquid copper provides final density. With proper development, the process elements have application to machine elements and structural parts. ■



Simpler, Less-expensive Honeycomb Sandwich Structure Reported

CULVER CITY, CALIF—A relatively inexpensive honeycomb core sandwich construction, reported to have unprecedented high strength-to-weight ratio, has been designed by Orvil S Tuttle, and is being manufactured by Monogram Precision Industries, Inc.

Known as Pelcor, it is a sandwich panel made by joining two stiffened skins which can act structurally as a plate. In the major axis, the structure will act as a stiffened beam to carry flexural stresses and shear loads, and as a column with stiffened faces to carry the axial loads. In the transverse axis, the structure acts as a true truss to carry flexural stresses and shear loads, and as a column with stiffened faces to carry the axial loads.

As shown in drawing above, Pelcor panel's corrugated core is actually a formed sandwich panel made with two very thin, high-strength facings separated and joined with a light-weight foamed adhesive, or ceramic bonding material. Stability and stiffness of core is increased without penalty. Tests of the configuration show that under the same loading and span condition, the deflection of the transverse specimen is only 1.8 times the deflection in the longitudinal test specimen.

Corrugations can be formed on high speed corrugating rolls using metal foil. For limited production or for tapered shapes, the corrugations can be formed using a press brake. Explosive forming is one of several means of forming compound curve shapes. Simple curves can be formed by bending the individual skin and corrugation assembly before joining into a completed Pelcor panel.

Flat panels are assembled by nesting the corrugations; pressing them together between heated platens. Stops between platens determine the exact thickness of the panel as the bonding material foams to fill the space between the surfaces of the corrugated shapes.

As forming operations are not difficult, dimensional tolerances of parts to be joined are not critical, and no heat treating is necessary. As such, a number of high strength alloys can now be used in sandwich structures. These include: stainless-moly-carbon steels, tin plate, titanium, aluminum and magnesium among others.

Because of the gap-filling or foaming action of the bonding material used to join the two stiffened skins, the entire mating surface of each thin corrugation is supported, yet separated, to stabilize the corrugation as a unit. This separation, in addition to providing structural stability for the core, is an effective insulation to the flow of heat through the panel. In fact, the panel as a unit is very effective as insulation, particularly at high temperatures. Because each foil thickness making up the corrugated core is very thin, there is no metal mass to store and conduct heat between outer and inner skins. Equally important, the radiant heat is reflected by the mirror surfaces of the two thicknesses of foil and by the inner face of the panel skins, greatly increasing thermal insulation efficiency of the panel. ■

Tempest over TEL?

NEW YORK—A new process revealed by Karl Ziegler of low-pressure (linear) polyethylene fame, is sparking predictions of make-it-yourself high-octane plants. The facts are interesting, but not quite that exciting yet.

The new Ziegler process, like the

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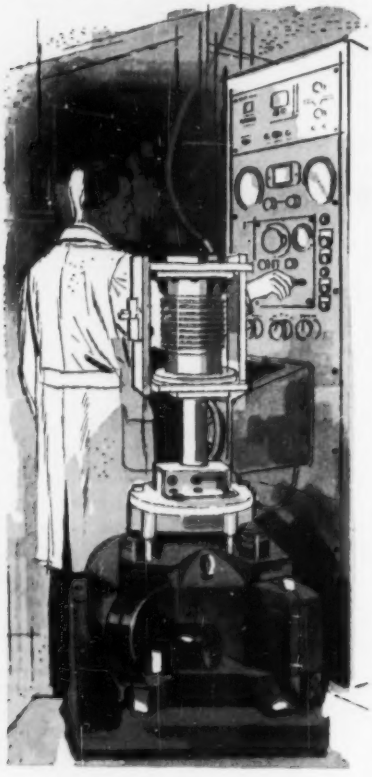

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low-pressure polyethylene system, is a catalytic technique, starting with sodium hydride, lead, and ethylene and using an aluminum trialkyl as the catalyst. The importance of the process—and its major difference from previous methods—is that it produces liquid sodium as an end product, rather than solid aluminum or other materials—and the liquid metal is far easier to handle.

But "easy" is a relative term, and a "small" plant may still be pretty big. Furthermore, as Ethyl Corp points out, this is only one of several TEL processes now being explored; one of which, says Ethyl, cuts sodium and chlorine consumption in half and virtually eliminates need for recycling of lead. A report on recent advances is scheduled to be issued "in the near future." —ARG

Design 10 Million-watt Plasma Arc-Jet

EVERETT, MASS.—A 10-million-watt high-pressure arc plasma generator which simulates the conditions incurred by a nose cone or satellite re-entering the earth's atmosphere has been developed by Avco-Everett Research Laboratory here. The generator is operated by a dc power source capable of supplying 10 million watts of power to the arcs. It operates at pressures encountered by ICBM nose cones and satellites at peak re-entry heating conditions.

Details of the giant generator were revealed in a paper presented before the semi-annual meeting of the American Rocket Society at San Diego by Peter H Rose, William E Powers and Daniel Hritzay of the Avco-Everett Research Laboratory, who developed the facility. The electric arc plasma generator complements Avco's shock tube (*PE—June* 1, '59, p23).

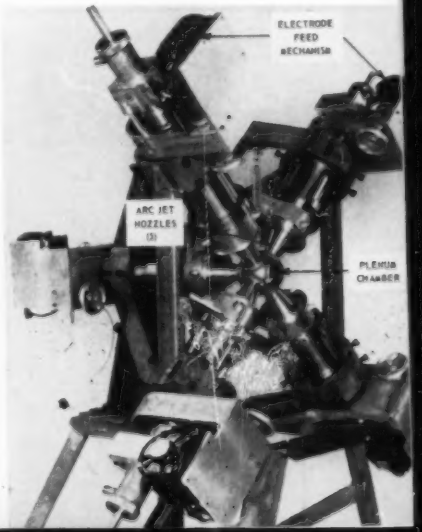
The plasma generator consists of five arcs exhausting into a 4-in.-dia spherical plenum chamber. Five arcs are used instead of one because of the impracticability of cooling a single unit of this power level. Each of the five nozzles are supplied from separate power sources to insure a uniform distribution of power. The remainder of the device consists of a high pressure air supply consisting of a water cooling system, two 5000-gal water tanks and Worthington centrifugal water pumps, and a dc power supplied by 2000 Willard truck batteries.

The air to be heated is injected through tangential injection ports. This swirl of air stabilizes and distributes the arc in the water cooled copper anode. A graphite cathode is held in a water-cooled holder and is fed by a motor-driven power screw. Cathode currents are up to 6000 amps. The 15,000-deg air passes over models so that scientists can study material behavior under this condition.

The device can duplicate both laminar and turbulent flow conditions on a model body. This is extremely important as it is known that 95% of the material lost by a typical high performance ablating nose cone during re-entry is lost by turbulent ablation. The facility provides a means for evaluating the performance of an ablating material under realistic duplication of re-entry conditions. This is of special significance in the many cases where re-radiation from the hot ablating surface back to the air contributes a large reduction in the effective heating rate experienced by a body.

The early ablation experiments performed on the 150-kw electric arc tunnel led to the development of Avcoite, an ablating material used on one type Thor-Able nose cone. The re-entry vehicle, flown April 8 this year, was the first successful 5000 mile range nose cone recovered from the South Atlantic.

Research has been supported by USAF's Ballistic Missile Div, Air Research and Development Command. ■



Gage Measures Irregular Surfaces

VIENNA—Two Rumanian engineers have won a patent from their government for inventing a gage that measures surfaces of objects with irregular contours. The gage operates by counting electrical impulses along each flat surface, then totaling these impulses to obtain area for the entire surface.

The apparatus includes two rollers that move along the work object; shims, mounted on the rollers to close electrical contact points; an impulse generator; an impulse collector that operates a rotating hand; and an electronic counting mechanism. The rollers and rotating hand are synchronized so that one revolution of the hand occurs as the rollers move forward one centimeter (0.394 in.).

When the object to be measured presses against the shims, it closes the electric circuit that links the impulse collector with rotating hand and electronic counter. Hence, the rollers provide a point-by-point reading as they move across the object. Shims are 1 cm apart. The inventors say that their gage is accurate to within 1%. ■

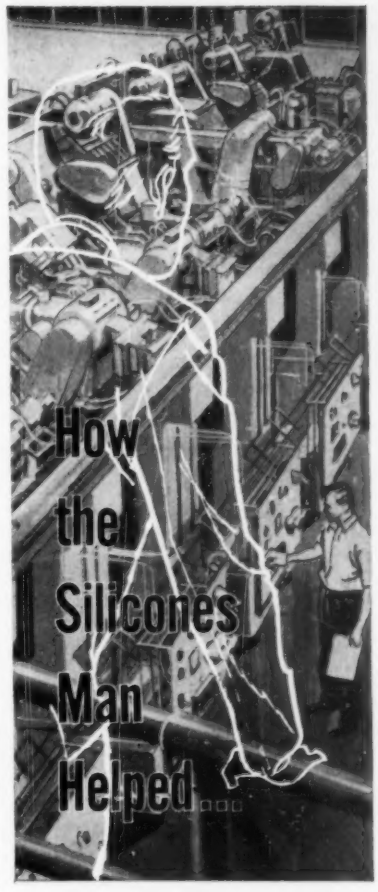
ASA Sets Bearing Standard

NEW YORK—The American Standards Association has set new standards for instrument precision ball bearings to suit the high requirements for precision in today's advances instruments and mechanisms especially for aircraft and missiles.

The standards establish boundary dimensions and tolerances, size classifications used for selective assembly, internal radial clearances, and certain other requirements.

Completed during the summer of 1958 by the ASA Sectional Committee B3, the new standard was approved in January, but has just been published. It grew out of a standards recommendation of the Instrument Precision Ball Bearing Committee of the American Ordnance Association.

The new standard is presently being considered as a world-wide recommendation by the International Organization for Standardization's



AQUEOUS EMULSION RELEASE FOR MOLDED SYNTHETIC RUBBER

The range of silicone release agents for molded products marketed by UNION CARBIDE has been further widened. Latest is a silicone oil-in-water emulsion with excellent compatibility for organic materials. This property of the new non-methyl emulsion is in the compatibility area between that of dimethyl silicone oils (very low) and that of organo-substituted silicones (high).

Outstanding among the features of the silicone emulsion are its inertness and ease of removal (any common solvent can be used) from mold and product. These advantages permit use of the emulsion in reactive systems without risk of harmful side effects, and eliminate the difficulties of subsequent painting or labeling. The silicone emulsion itself is nonionic, stable, no more corrosive than water, and has a pleasant odor.

Manufacturers of automobile mats and home floor tiles have discovered that the silicone emulsion speeds production and gives a clean product. In emulsion-type waxes and polishes, the emulsion is added in trace amounts to increase mar and scuff resistance.

LOW-HEAT CURE FOR HIGH-HEAT VARNISH

A new silicone varnish, developed by UNION CARBIDE, requires only relatively low curing temperatures in ordinary ovens and regular drying equipment. Baking ovens capable of 275° F. or higher temperatures can be utilized, following routine procedures for varnish dip and bake.

The new silicone dipping varnish is approved for electrical insulation, Class H applications—as in transformer coils, motors, generators, and other equipment. It is equally effective for high temperature and/or heavy duty, continuous service, in large or small apparatus.

Silicone varnish with low temperature curing properties provides a nontacky surface with less weight loss than other silicone varnishes. It gives high build and gloss, with good impregnating and bonding.

In addition to heat resistance, the new varnish is resistant to humid and corrosive atmospheres – important causes of insulation failure. No additional water repellents or chemical-resistant coatings are needed to obtain full protection.

PREVENTING SURFACE OXIDATION OF MOLTEN METALS

A high-boiling silicone oil, floated on the surface of molten metal used to heat-treat nylon cords and yarns, is helping British textile processors to prevent atmospheric oxidation of the metal bath. The temperature of the metallic mixture ranges from 160 to 240° C., and the method has been patented.

This is a practical example of the heat-resistance of films formed by silicone oils.

The Silicones Man is accustomed to helping solve problems like these . . . and he may be able to help you, too. For background information on these and other applications, write Dept. FP-0903, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

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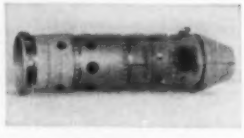

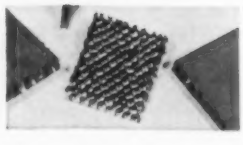

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Technical Committee 4, Ball and Roller Bearings. Copies of the standard, B3.10-1959, are available from the ASA, Dept. PR 79, 70 East 45th St., New York. ■

Bristol-Siddeley Bares Detail of New Engine

LONDON—Bristol-Siddeley has announced brief details of its new BE 53 lift-thrust engine capable of both direct lift and forward flight.

The firm says the ducted fan engine has a thrust-weight ratio higher than that of any existing turbojet. This means that high speed aircraft can be designed with both VTOL and STOL characteristics. Such craft will eliminate the need to carry the dead weight of vertically mounted lifting powerplants useful only for take-off and landing.

Bristol-Siddeley said take-off thrust of the BE 52 is of the same order as the Olympus, which places it in the neighborhood of 16,000 lb. Specific fuel consumption at cruising is said to be very low. And reverse thrust can be provided for braking. ■

New Ceramic Approach to Aircraft Insulation

LOS ANGELES—Ceramics for insulating structural parts where temperatures range above 2000 F are now being applied by troweling a ramming mixture onto metal to which corrugated strips of reinforced metal have been spot-welded. This work is now in an advance stage of lab development at Marquardt Aircraft Co.

Several types of the ceramic have been developed. These embody many combinations of reinforcing media and ceramic material. Those investigated include:

- Wire mesh of mild steel—300 series stainless—and molybdenum
- Expanded metal of mild steel and molybdenum
- Corrugated metal strips made from mild steel and tantalum
- Fibers of ceramic material, primarily aluminum silicate and quartz or refractory metal randomly oriented in ceramic matrix and laminated throughout.

The types of ceramics that have been reinforced are:

- Sodium silicate base with refrac-

tories such as alumina, mullite, kyanite, silica.

- Phosphate-bonded alumina, zirconia and chromia.
- Pure aluminum zirconia.

Continuous network of reinforcements are required to firmly anchor the coating to the base metal. These reinforcements are brazed or resistance welded to the base prior to application of coating.

WHAT THEY DO

Such reinforced ceramics withstand steady-state temperatures in the range of 2500-4000 F. They also cause a thermal drop through the system at steady-state heat flux of 10,000 Btu/ sq ft/ hr or greater of approximately 10 F for a material heated on one side only. And they have thermal conductivity in the range of 5-10 Btu/sq ft/ in. hr.

Jet Drone Electronics

First US over-the-horizon radar command-guidance system is demonstrated by Sperry Gyroscope Co. The system, employing a technique called pulse code modulation, uses a single radar frequency band to command and track the drones, and telemeter flight data. This replaces three separate systems used previously. Ground director station containing all elements for directing the mission is housed in a trailer. When in action, a radar operator will pick up the flight of the drone to assure its adherence to a pre-set flight path. Monitoring and commanding changes in the flight are accomplished by two controllers, seated in front of a control console and plotting board.

Here's an excellent example of our ability to handle *tiny* wire cloth insert assemblies on a production basis. Of the three pieces involved:

a we punched out the tiny circular pieces of 100 mesh stainless steel cloth.
b we punched out the silver solder rings.
c we purchased on buyer's specifications the stainless steel recessed parts.
d assembled unit.

And to produce this tiny assembly we developed a unique method of induction brazing, necessary to get high production rates in the brazing operation.

We've fabricated many large insert pieces, some several feet across; also countless medium sized parts. We thought you might be interested in the type of work we do in the 'miniature' field. However, no matter the size or shape of the part you want assembled with a wire cloth insert, we shall be glad to carry it all the way through . . . help in design, best method of inserting, quote and produce.

This Bulletin describes our work in connection with wire cloth inserts. How many copies would you like for you and your associates?

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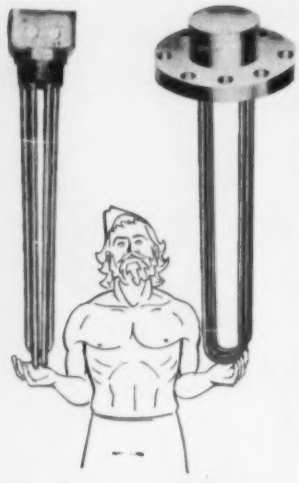

VULCAN

IMMERSION HEATERS

Vulcan Electric Tubular Immersion Heaters offer a choice of flange or threaded bushings; bayonet type, side or bottom outlet; copper, steel, stainless or alloy sheath; single or three phase; 500 to 10,000 watts (or higher); 120, 240, 480 volts (or higher); pressures up to 3500 psi.

Vulcan Immersion Heaters are ideal for heat transfer to all types of liquids — water, oil, wax, paraffin, asphalt, tars, etc.; in tanks, boilers, urns, kettles and other containers.

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See Fuel Cells as Key to Transport Problem

WASHINGTON—Demands for new and improved power sources are spotlighting research devoted to development of fuel cells (*PE—June 22, p 41*) as means of generating power.

• A revolution in transportation through development of fuel cells that convert hydrogen and oxygen into electricity is predicted within 5 years by Gilbert W Chapman, pres of Yale & Towne Co.

• Coincidentally, an optimistic report of Defense Dept's progress in developing the fuel cell was issued by a committee comprised of representatives of the Army's Signal Corps, Ordnance, Corps of Engineers and the Army Research Office.

The report which analyzes military problems concludes that practical use of fuel cells as a development is still a few years away but that there is a possibility of using hydro-carbon fuels or their partial oxidation products in a low-temperature device. B R Stein of the Army Fuel Cell Steering Committee and author of the report, said that the latter approach would have application for large scale power sources, as well as for those in medium and small power ranges. ■

Company Puts Heat on Printed Circuits

STAMFORD, CONN.—A printed circuit that operates without deterioration at temperatures exceeding 1300 F is under development at Advanced Vacuum Products, Inc., here.

The substrate or base material on which wiring is printed is made of an oxide of aluminum. A molybdenum-manganese compound that is fired onto the alumina then brazed is used for wiring. Bonding is said to be so adherent that the circuit cannot be removed without destroying the alumina base. Hence, circuitry cannot be torn, shaken or broken off the board.

Other virtues claimed for this printed circuit are that it does not absorb water, returns to its original shape after exposure to high temperatures, and continues to operate after an electric arc occurs.

The company says that certain problems remain to be solved before large units can be constructed. ■

Electroauro technics

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(aqueous) the world's purest soluble gold, specified and used by many leaders in the Missile, Atomic and Electronic fields.

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The first NEW development in gold electroplating in over 100 years. It produces electroplates both hard and ductile using ONLY ONE addition agent operating at room temperature under POSITIVE and simple control.

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The only bright gold operating with less than 1/10 ounce free cyanide per gallon at room temperature, offering variable hardness to fit your specifications . . . at a non-premium price.

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A superior rhodium concentrate of high purity offering low stress deposits and tight grain structure.

Full information on these superior soluble metals is available upon request . . . also the complete resources of our laboratories, and the most experienced Precious Metal Plating metallurgists in the world are at your service, without obligation. Phone, TWX, wire or write.

Technic

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Some Ideas

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

Frankly, we hope you're a fusspot. If you are fussy about the way you work, and proud of it, we think you'll enjoy knowing about three K&E items which reduce the effort required to get pin-neat results. Our first suggestion is . . .

A Better "Mattress" for Your Drawing Board

For effortless drafting, a good board cover is about as important as a good mattress is for sound sleep. Which is why so many draftsmen swear by LAMINENE® (N 70), the only *laminated* board cover material made. An exclusive, patented K&E process gives LAMINENE several very practical advantages over plastic coated papers. You can stretch it, drumhead-tight, over your board. All you do is wet the back, then secure the ends by taping or stapling to the underside of the board. After drying, LAMINENE grips the board as if cemented – there's no rippling, no stretching with the weather, no slack to take up. Its "drafting feel" is perfect: just the right balance of firmness and resiliency. LAMINENE'S non-glare surface makes it easier on the eyes, too, even under fluorescent lighting. You can expect to leave the board feeling fresher, even after a long day.

What's more, LAMINENE won't crack or scar like a plastic coating. Its laminated film surface is flexible, and stays that way – no crevices form to pick up workaday grime. It's easier to clean, too. A little soap and water is all it takes to keep LAMINENE looking like new.

LAMINENE is available in White or Eye-Ease Green; plain or with 4 x 4, 8 x 8 and 10 x 10 grids to the inch, which act as permanent two-way tracing guides. A free sample can be yours in a few days if you write us today. If you've never tried a laminated board cover, we promise you a new experience!

Stickers With Delayed Action

Want to eliminate a time-consuming chore? You can cut down on tedious repetitive lettering by having title blocks, specifications, and other symbols or legends printed

– clearly and sharply – on DULSEAL™ (74). This tissue-thin film has a delayed-action adhesive on the back, and a dull-finish face for easy writing or printing. Stickers made of Dulseal can be firmly positioned—and re-positioned hours later, just as firmly. The adhesive takes 24 hours to set. Once it does set, a permanent bond is formed with the paper or cloth beneath. Dulseal is chemically stable, and the adhesive will not bleed, even in hot copying machines.

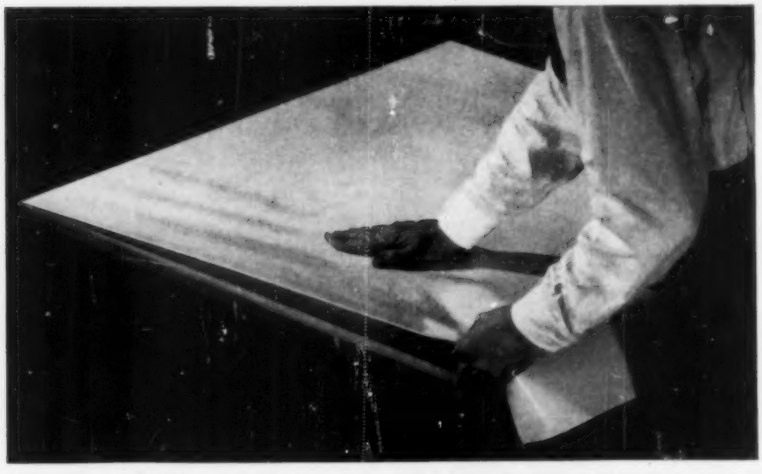
Repeated erasures on Dulseal will not affect its "take." Produced by an exclusive process, the "tooth" is *built into* the surface. Transparent and low in reflectivity, Dulseal stickers will not affect the transparency or printing speed of your drafting medium. K&E supplies Dulseal in sheets, rolls (printed to your specifications if you wish), and as a mending tape in a handy dispenser. Try a sample, on us!

3 To Keep Clean

Best way to keep your tracings clean: don't let them get dirty. A mighty easy way to achieve this is to sprinkle the tracing lightly with gum eraser particles, while working. Then, triangles, T-squares, and scales stay clean, and clean the surface *automatically*, as they are moved back and forth. The particles will not dry out or harden – they contain no grit or abrasives. They'll actually improve the ink taking qualities of your drafting surface.

For this purpose, K&E supplies cleaning particles put up in three different ways. We think the new plastic squeeze-bottle (3036C) is the handiest of all. The shaker-top can (3036) has also been a drafting-room favorite for some time. And, for double-duty cleaning, we suggest the ABC Dry-Clean Pad™ (3037), which holds slightly coarser granules that sift through soft mesh. The ABC Pad also comes in handy for wiping a complete tracing after it is finished, or for preparing certain surfaces for ink work. Or for an overall pre-cleaning, since the best way to insure clean tracings is never to let soil build up.

The proverbial ounce of prevention is worth the traditional pound of cure!



These K&E products, and others that can make life easier for you, are available from your nearby K&E dealer. See him soon . . . or send us the coupon below for further information and samples.

KEUFFEL & ESSER CO., Dept. PE-6, Hoboken, N. J.

Please send me samples of LAMINENE® Drawing Board Surface Material, and DULSEAL™ Tape . . . plus information on K&E cleaning powders.

Name & Title_____

Company & Address_____

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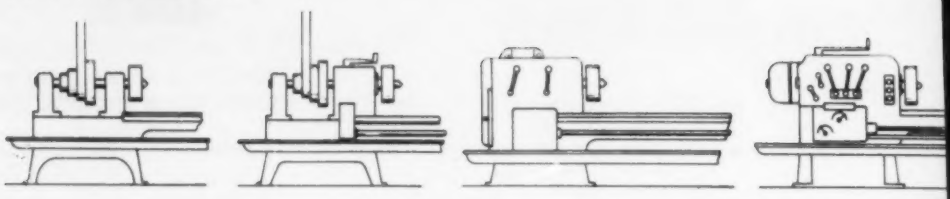
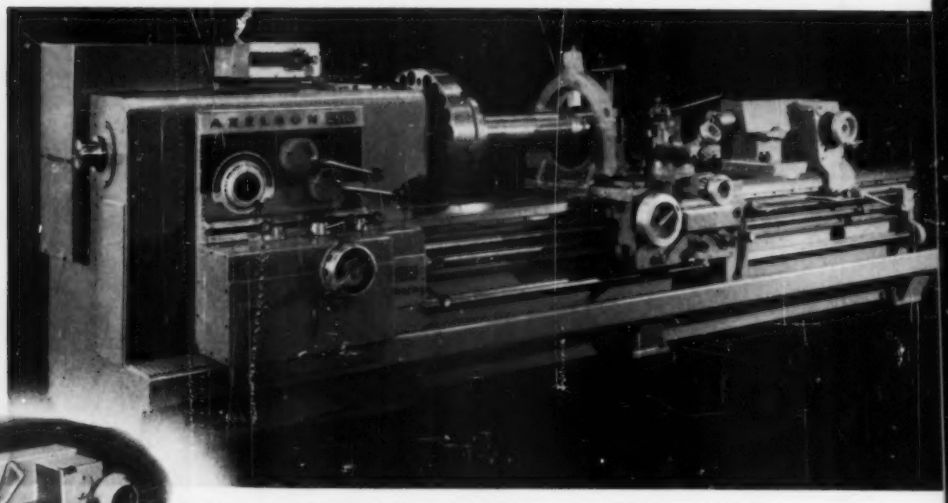
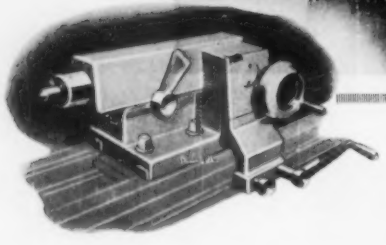
2002

TRENDS in appearance design . . .



Lathe is all-welded for rigidity





● Fingertip dialing of water temperature is provided by this mixing faucet, designed by Hans Bellmann, for Armaturenfabrik Wallisellen AG, Switzerland.

...odular for flexibility

●The use of carbide and ceramic cutting tools is growing, and this calls for more structural rigidity in such metalworking equipment as engine lathes. So the Clearing Div of U S Industries Inc decided to base redesign of the Axelson lathe on its experience with all-welded steel construction in hydraulic and mechanical presses. Modular construction and unitized power and control elements, increased horsepower, greater range of spindle speeds with either manual or power shifting—these were among the major engineering objectives. They were to be contained in a machine that could be priced competitively.

While operating prototypes had long been in production shops, J M Little & Associates, Maumee, Ohio, industrial designers, were given only a year's time. Drawings of the bed were supplied before concepts of the headstock had been finalized. Although the term "all-steel" applied only to headstock and bed (tailstock, apron, cross slide, gear box and brackets are cast) the designers had to think mainly of plate cut by torch, bent by press brakes and welded.

Another requirement: This machine is a horizontal engine lathe; therefore horizontal forms accented by color could best provide unity and simplicity. The resulting crisp look of this lathe is not just some more of the currently popular "sheer look." It shows the difference between this machine and those developed from castings. For example, a headstock made of poured metal often has curvatures and subtle changes in surfaces to minimize the distortions caused by cast internal sections such as ribs.

Every major power and control component has been unitized, and may be separately replaced by units of different capacities—or removed for servicing. A bed of any length or type can be mounted on this control-headstock unit by means of a thick, extra-wide flange.

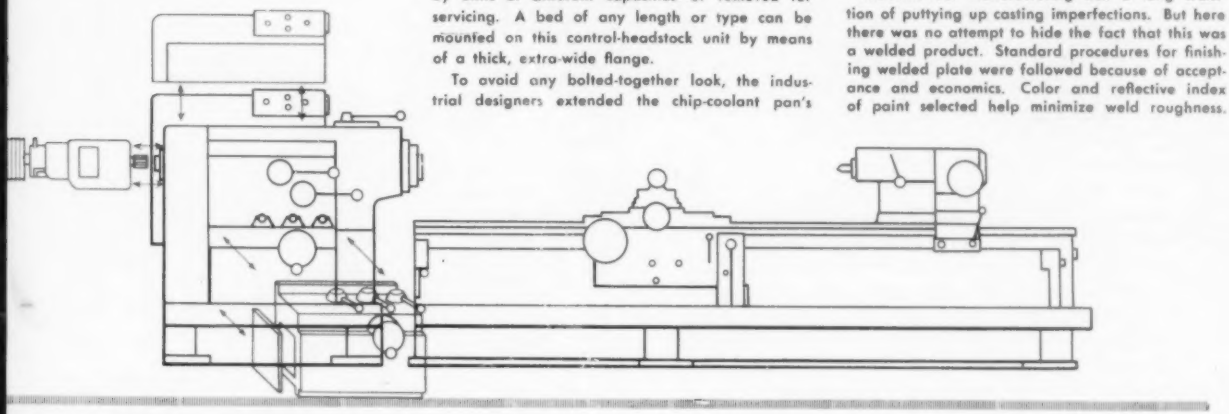
To avoid any bolted-together look, the industrial designers extended the chip-coolant pan's lines through the headstock. It also gave the machine's foundation continuity and carries out the horizontal motif.

All control levers and other devices, including the electricals, are in a spherical arc whose radius is 24 in.—the operator can perform major operating tasks without taking a step.

Differentiation between energizing (such as motor start, stop) controls and those governing rate of speed feed and traverse movements is obtained by stratification and color coding.

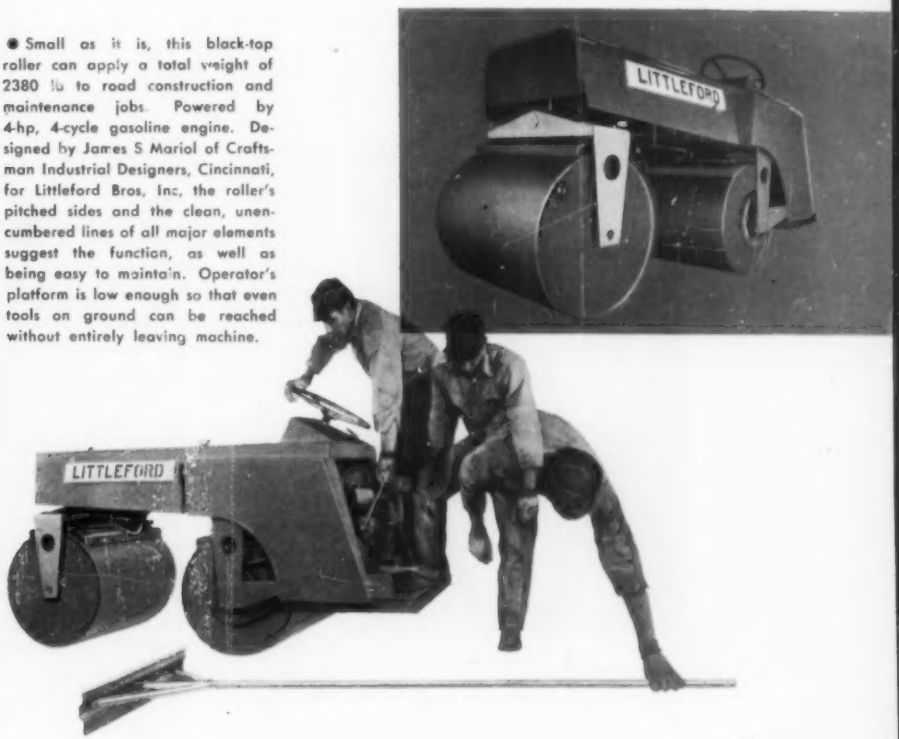
Because the traditional machine-tool grays do not offer enough contrast with metal surfaces that are left unfinished, as well as the chuck and workpiece itself, a blue-green was selected as the principal color. It also doesn't "cover up" splashed coolants, grease and dirt; it tends to show precisely where a cleanup might be in order. Chips requiring removal are also more visible. Moving parts can be more easily observed.

Machine-tool manufacturing has a long tradition of puttying up casting imperfections. But here there was no attempt to hide the fact that this was a welded product. Standard procedures for finishing welded plate were followed because of acceptance and economics. Color and reflective index of paint selected help minimize weld roughness.



At the recent International Automobile Salon ...eneva, Switzerland, an auto body designed ...inin Farina for a Ferrari cehassis had a ...mnless windshield. Two types of safety steering ...els were exhibited by Porsche. One had a ...raulically damped, telescoping post. Another ... concave sections in the wheel, to absorb ...act energy in a collision and also to afford ...ore secure grip on turns.

● Small as it is, this black-top roller can apply a total weight of 2380 lb to road construction and maintenance jobs. Powered by 4-hp, 4-cycle gasoline engine. Designed by James S Mariol of Craftsman Industrial Designers, Cincinnati, for Littleford Bros, Inc, the roller's pitched sides and the clean, unencumbered lines of all major elements suggest the function, as well as being easy to maintain. Operator's platform is low enough so that even tools on ground can be reached without entirely leaving machine.



POINTS O

THE QUESTION: ***Can There Be Too Many Engineering Shows and Conferences?***

"Participation in any meeting . . .

must result in business benefits. Before this can happen, the meeting must result in valued acquaintances, lessons, ideas or problem solutions. Theoretically, there cannot be 'too many' with these qualities. But, it is also important that sufficient time be left over to integrate these benefits into the regular business operation.

"The question also implies a matter of sincerity. In our experience, most visitors to trade shows, conventions and conferences pursue a conscientious course at the meetings—heightened by the welcome relief from business routine. If these gatherings are too frequent, however, it fosters the development of the 'convention bum' who, even at worthwhile programs, measures his benefits by the severity of his hangovers.

"Those who conduct or produce the meeting should also be serious about giving the program some real value. For example, trade show exhibitors should not only present their product but demonstrate its uses and attributes. Competent personnel should be on hand (and on their feet) to work out solutions to any problem a visitor might have.

"The atmosphere or environment of a good program is one conducive to serious consideration of the material. Perhaps utopian conditions for these meetings could be found if all shows, conferences, etc., were held simultaneously in vast temporary facilities set up on the plains of Kansas during a pleasant season. This elimination of side distractions would lend . . . You're smiling!"

RUSSELL J CAMERON
President
Ross Operating Valve Co

J F FAIRMAN
Sr vice-president
Consolidated Edison Co of NY

"Employers view with concern . . .

the increasing number of major meetings and conferences held under the auspices of the engineering societies and other groups. Supervisors to whom I have spoken on the subject are responsible for determining to what extent they can justify the participation of their respective staffs and many say they are bewildered by the multiplicity and apparent duplication of requests coming to their attention.

"The problem is a natural one in the growth and development of the various societies, each trying to serve its members and advance the several engineering arts through meetings and conferences. Interest in the atom, for example, finds each of the disciplines scheduling meetings on nuclear technology. Interest in missiles and outer space is presently running across the various lines into which our profession is customarily subdivided. The hazard, of course, is that too many of the meetings are devoted to the same subject. The same authors or their close associates are on the podium and the same people are in the audience. Except for the different locale and the different initials of the sponsoring society, it might very well be the same meeting.

"The solution, in my opinion, is to be found in some over-all planning and control. A means of cooperation and coordination among the several societies can and should be devised to the end that there will be fewer and better engineering meetings."

VIEW

"There cannot be too many . . .

good engineering shows and conferences since this is the best modern-day method of supplementing other means of technological communication. Unfortunately, a few of the conferences are not up to standard in that they are either duplicative of, or overlap others, or are not well planned from the point of view of level of presentations or attendance.

"Localized methods of getting technical information include textbooks, technical journals and magazines, reports, and examination and testing. A good engineering conference affords the supplementary method of hearing the latest from nationally known experts in the commodity or functional field. The opportunity is present to find out not only what others are doing, but to get a broad appraisal of what you yourself are doing. Not the least of the advantages is the opportunity to talk with knowledgeable people during panel discussions and between sessions. Published papers from a well-planned engineering conference provide a timely compendium of the best thinking in the area of interest for future reference and for the fellows back home.

"More discrimination should be used in selecting subject, time, presenters, and attendance. This would probably result in fewer meetings but they would be more contributive to the advancement of our technology."

R W CUTHILL
Chief engineer
Army Ordnance Missile Command
Redstone Arsenal

GLENN B WARREN
President, ASME
Vice-President
General Electric Turbine Div.

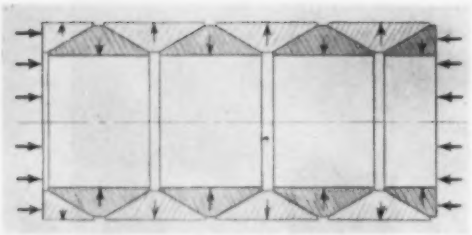
"Certainly, there can be too much . . .

of any good thing. Just what are enough engineering conferences, technical society meetings, technical papers, and engineering shows, is a matter of careful consideration and judgment by people who are concerned with these matters. If a curve is plotted of our productivity per individual against time in any of the Western nations, its steep upward slope begins with the birth of scientific and engineering technology and the beginning and growth of scientific and technical societies.

"The problem presented today to a very great degree has been intensified by the almost explosive nature of the diversification of scientific and engineering technology into areas not previously known, and into forms of scientific and engineering activity not previously in existence. The demand of these new technologies for expression and consideration in this area is so great that if the existing societies do not provide a channel for their expression, additional splintering will take place and the whole situation will become even more confused and ineffective. The proper balance must be maintained by the existing technical societies of adequately covering the new portions of technology that are springing up without throttling the strength that comes from the additional decentralization permitted by a certain amount of favorite splintering, and thus permitting, where desirable, the birth of new societies such as the Rocket Society, for example, which has recently come out of the ASME and now stands on its own.

"In the critical race in which the Western world is in with respect to technology, every effort must be made to permit the maximum possible growth and expansion of our science and technology by the maximum practical interchange of ideas, information, results, and inspiration. Fortunately, like most problems in optimization, the over-all favorable results are approximately constant over a fairly wide spread between what is too many and what is too few of the principal variable which in this case is how many meetings and conferences do we have, and we, therefore, do not have to settle this matter too exactly in order to obtain our objective, namely, the optimum speed of our scientific and technical progress."

SIGNIFICANT COMPONENTS MATERIALS PROCESSES



Bushings have adjustable . . .
radial dimensions to provide exacting fit without machining. Series of alternate male and female segments, aligned axially, are mechanically adjusted to vary ID and OD of bushing. Application of axial compressive force to ends of bushing causes male segments to assume smaller dia, reducing ID; at same time, female segments assume a larger dia, increasing OD. All segments are slit axially through one wall to facilitate adjustment. Simultaneous decrease in ID and increase in OD results in thicker bushing wall. Typical applications include use with close-tolerance fasteners, to salvage over-size holes, as anti-backlash hinge and pivot pins, replacement of taper pins and pressed-in-place pins, as seals around bolts, and as shaft clamps. Adjustable wall-thickness bushings are offered in materials that include metal powders, bronze, nylon, Teflon and stainless steels, in standard and special sizes. About ½¢ per segment up. Delivery, stock to 4 wk. **Globe Bushing Corp, 12036 Vose St, North Hollywood, Calif.**

Circle 101, Reader Service Card

Level-sensing potentiometer . . .
utilizes motion of air bubble in curved glass tube, partially filled with electrolytic solution, to provide error signal. Three electrodes are arranged so that resistance from two operational electrodes to common electrode is equal when unit is horizontal. When tilted, air bubble moves, causing resistance to increase on one electrode and decrease on other. Typical unit has operational-to-common electrode resistance of 700 ohm when balanced. Designed to signal small deviations, unit reaches saturation at about ¾°. Measures 1¾ in. long, including leads, and $\frac{3}{8}$ in. dia across body. Other models offer various electrical and tilt specifications. Suitable for use in gyroscope-correcting mechanisms and remote tilt-measuring devices. $15 net each, FOB Evanston. From stock. **Hamlin Inc, 1316 Sherman Ave, Evanston, Ill.**

Circle 102, Reader Service Card

Subminiature gas-density switch . . .
signals when density of surrounding inert gases approaches critical value. It actuates along, or parallel to, any temperature-pressure line from 0.028 to 0.040 psia per degree Rankine. Accuracy of actuation point is 0.8 psi over the range from −85 to 200 F. Differential between actuation and deactuation pressure is 2 psi. Available as SPST or SPDT units, rated at 28 v dc, 110 v ac, 5 amp. Meets military environmental specifications of 20 g shock, 5 to 1000 cps at 10 g vibration. Switch which measures $2\frac{3}{32}$ in. long x $1\frac{5}{32}$ in. dia, weighs 2 oz. Suitable for detection of gas leakage in closed volumes where normal gas pressure varies with temperature; to detect critical arc-over gas densities; to signal gas densities in processes that are subject to wide variations in temperature. **Newark Controls Co, 15 Ward St, Bloomfield, NJ.**

Circle 103, Reader Service Card

Self-compensating hydrostatic bearings . . .
in liquid and gas types, are said to reduce friction to 1/100 or less of friction produced by conventional ballbearings and can be made with as high spring constant as necessary. Gas bearings are reported to be well suited for high-speed use, such as drills and dynamometers. Liquid bearings are particularly applicable to high-precision uses and devices requiring large loads with nearly zero striction recorded. Because metal-to-metal contact has been eliminated, life of bearings is said to be infinite. Designed and produced for specific applications. **Modern Design, Div of H C Schloer Inc, Vestal Building, Vestal, NY.**

Circle 104, Reader Service Card

High-tension fasteners . . .
have carburized teeth on flanges of one-piece screw and nut, angled on advancing side to allow low-friction tightening, but are vertical on back side to prevent loosening. Circular flange groove increases diaphragm action, flexing flange as teeth

imbed upon seating to maintain residual tension in fasteners. Locking fasteners are said to require almost 150% of application torque to loosen. Reusability is said to be good. Prelubricated screws and nuts have tensile strength of 125,000 psi. Available in sizes from No. 6 to ⅜ in. Screws can be produced in any length from twice dia up and in a wide range of sizes and styles, except flat-head. **Russell, Burdsall & Ward Bolt & Nut Co, 103 Midland Ave, Port Chester, NY.**

Circle 105, Reader Service Card

Electronic liquid-level unit . . .

senses presence of liquids and any change from liquid to gas or vice versa. Basically, sensor is light switch with light source, optical prism, solar-cell sensing element and miniature 3-stage, direct-coupled transistor amplifier, which operates DPDT miniature relay. Said to operate in many diversified fluids, such as liquefied gases, hydrocarbon fuels and water. Built-in amplifier and relay can be separated from sensor probe for specific applications. Light rays from miniature bulb are directed down one side of prism, reflected internally from two 45° prism surfaces and transmitted up other prism surface to solar cell. When prism end of probe is immersed in liquid, refraction of light is changed to permit rays to pass into liquid without internal reflection; when prism is in a gas, rays are internally reflected. Signal is transmitted to relay, which has response speed of 20 millisec or less. Relay contacts are rated 3 amp, 28 v dc or 115 v ac. On-off unit operates on 28 v dc. **Pioneer-Central Div, Bendix Aviation Corp, Davenport 1, Iowa.**

Circle 106, Reader Service Card

High-speed stepping relay . . .

can automatically home to zero at 50 pps and follow a square wave pulse of 25 millisec. Produces direct readout of 0 to 9, carries at 9 to next decade, provides signals for printed readout. Consists of number wheel, relay, three printed circuit boards, switchboard, codeboard and circuit board. Pawl, which pivots on nylon bearing molded onto armature, engages ratchet gear on unidirectional number wheel, which is actuated by proper voltage. Can be assembled so that any number can be brought up on number wheel by external selection. SPST-normally closed contacts are rated 1 amp, 110 v ac, noninductive. Impulse-operated models are available in voltages to operate on 24 to 115 v dc, 20 w. Dimensions 1⅛ x 2⅛ x 5¼ in.; weight 10 oz. Delivery, 2-3 wk. **Hillburn Electronic Products Co, 55 Nassau Ave, Brooklyn 22, NY.**

Circle 107, Reader Service Card

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Worcester, Massachusetts

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Technical school graduate or M.E. with minimum of 5 years experience including several years in area of preparing standards and developing procedures and systems. Familiarity with manufacturing methods is essential. Must be able to express self clearly and accurately.

Duties will include: preparing general manufacturing engineering standards for the approval of departmental and divisional supervision; working in conjunction with Tool and Gauge Planners for standardization of tools and tool components; reviewing engineering standards for compatibility with manufacturing engineering standards, and suggesting revisions and modifications as necessary; developing and recommending procedures or systems for internal control purposes in Production Engineering Department. This individual will function as Production Engineering staff representative in consultation with Materials Engineering and Production Control in establishing divisional standards, evaluating the accomplishments of these objectives, and modifying or revising as required within the limits of their scope and performing.

Kindly send resume and salary requirements to

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Industrial Relations Division

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ROCHESTER 3, NEW YORK

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Familiarity with tooling helpful.

Kindly send resume and salary requirements to:

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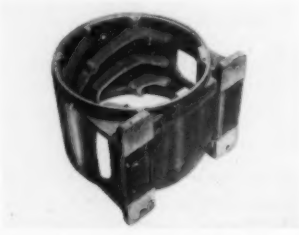

Rerated motors are cooled . . .

by air that circulates in a clockwise, spiral direction through space between stator core and motor frame. Spiral air motion is said to cool all portions of stator core and winding equally. Circulating air controlled by series of integral cast baffles, travels two independent paths in this double-end cooling system. Air intakes are located low on end bells; air exhausts are located between motor feet. In standard motor, ventilating air that enters at shaft end of motor, discharges on conduit box side. Conversely, air entering on free end, discharges on opening opposite conduit box. Design available in rerated frame 364U through 445U dripproof ball-bearing KZK motors. **Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago 5.**

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Thermal analog tube . . .

is for system breadboarding and evaluation before prototype state. Permits selection of thermal optimum component-layout and selection of the most thermally efficient hardware, mountings and enclosures by simulating actual electronic conditions. Tube is identical to any vacuum tube of same size class and, therefore, is an accurate thermal analog of electron tube under study, at its site. **Research Council Inc, 1062 Main St, Waltham 54, Mass.**

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NEW LITERATURE

The Tao of Science

R G H SIU. Technology Press of MIT, and John Wiley & Sons Inc, 440 Fourth Ave, New York 16. 180 pp, 6 x 9¼. $4.25.

As the word "tao" is used in a current book on Chinese painting, it can mean the philosophy and proper discipline inherent in a field of activity requiring talent, great skill or intellectual development. So the title of Dr Siu's book seemed to promise a much-needed appraisal of scientific procedures and problems of genuine usefulness–and his subtitle, "An Essay on Western Knowledge and Eastern Wisdom," suggests a comparison of two cultures and their most cherished values and concepts.

Unfortunately, the author shares the popular confusion over the distinctions between science, technology, art and crafts, and the cultural entities of which all of these form interconnected but separate parts. As for the relationships between Asian and our own philosophies, in only two chapters does Siu discuss them at any length.

Yet it is clearly evident that the author is widely read and has spent many earnest hours of thought and analysis on his subject. Despite the book's often romanticized reading of history and economics and a sketchy discussion of such basics as the motivations of science, the reader is likely to come away from this book inspired–probably to follow the many paths of further inquiry which Dr Siu tantalizingly reveals throughout the book. In particular, those engineers convinced of the inevitability of relationships between cause and effect are urged to read the chapter "Uncertainty of Scientific Knowledge." –JK

Automation and Society

Edited by H B JACOBSON and J S ROUCEK. Philosophical Library Inc, 15 E 40th St, New York 16. 6 x 8½, 553 pp. $10.

Automation, a word once coined to describe certain production machines which controlled themselves through a feedback loop, has now been applied to so many of the products of modern technology no one knows what it really means. This book will not help. It is a catch-all in the same way that the word is a catch-all. Here are a group of articles written by various authors, some of them authorities in the field. They describe automation in the automobile industry, railroad, post office and (of all things) teaching machines. Also discussed is the impact of automation on education, leisure, politics and economics. The common thread tying these together is the machines that do work once done by man. This, then, is the story of the industrial revolution, brought up to date with a new word. –CJL

MAN AND HIS WORK–Booklet, 32 pp. Part of "This is DuPont" series. Describes how growth of industrial technology has dramatically upgraded worker's skills, living standards and social status. Gains are related to cultural and economic changes. E I du Pont de Nemours & Co Inc, Public Relations Dept, Wilmington 98, Del.

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COMPUTER CONSULTING–Brochure, 8 pp. Answers such questions as, "Why consultants?" Also describes services available, specific projects, clients and key personnel. Marc Shiowitz & Assoc Inc, 13520 Crenshaw Blvd, Gardena, Calif.

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SILICONE-RUBBER SELECTOR–Chart, CDS-145. Specification guide to assist in selection of proper type of silicone rubber. Contains typical properties, primary classes, standard industry and military specifications and application information. General Electric Co, Waterford, NY.

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MINIATURE-CONNECTOR FACILITIES–Brochure, 4 pp. Illustrated account of facilities and techniques used in manufacture of electrical connectors. Deutsch Co, Electronic Components Div, 7000 Avalon Blvd, Los Angeles 3.

Circle 124, Reader Service Card

PRODUCT AND MARKET PLANNING–Brochure, 4 pp. Describes service for evaluating consumer reaction to production promotion, concept, use. Nowland & Co, King St, Greenwich, Conn.

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PLASTICS R & D–Technical bulletin RPR-1, 2 pp. Presents availability of research, development and pilot plant operations. Plastics Plant or Research Div, Raytheon Co, Box 25, Maynard, Mass.

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Publisher's Postscript...

Too much to read?

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Too much water—you drown.
Too much heat—you burn to death.
Too many taxes—you go bankrupt.
Too much to read—well, what can you do about it?

Reading is our business and judging by the action of PRODUCT ENGINEERING readers, it is getting to be your problem more and more every day. Although we work to make PRODUCT ENGINEERING so interesting and informative that it will become first and "must" reading, we realize that we can't saturate your reading time.

We felt we could help you with your general reading problem, however, so we recently published articles on "Five Steps to Faster Reading." We've gone back to press four times, have received orders for more than 8,000 copies of which 5,788 were individual requests for a single copy. If you have not sent for this free reprint, you can still have one by marking "Fast Reading" on the Reader Service card facing this page. Extra copies are 25¢ each up to 20, 20¢ up to 50, 15¢ up to 100 and 10¢ beyond 100.

Back in 1956, recognizing the need for the organization of design-engineers' reading habits, PRODUCT ENGINEERING undertook the task of screening, evaluating and sorting out the books best suited for the engineer's basic quick-reference library. We published this compilation, "The Engineer's Bookshelf", in March, 1957.

Reaction was not only immediate, but also continuous. Readers have bought 2,775 copies of this useful compilation. Orders have been received every *month* since publication.

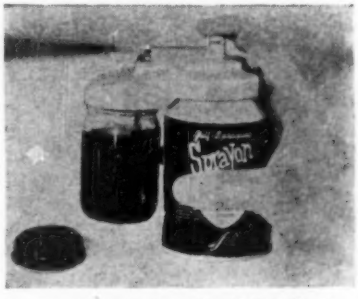
In the meantime, book publishers have been busy, too, and several thousand new books have poured onto the market.

So, our revision and updating of "The Engineer's Bookshelf" was printed in the March 30 issue. Its acceptance—once more—testifies to the pinpointing of your needs. Orders for 1,127 copies have already been received, ten weeks after publication.

If you missed this 16-page report and wish a copy, send 25 cents in stamps or coin to our Reader Service Department, 330 West 42 St., New York 36, NY. —SJA

For Your Information (personal)

You buy just the pushbutton part



At last: the convenience of aerosol spraying, with the product or material of your choice. Here's a propellant-filled can coupled to a glass jar in which you place the paint, lubricant, cleaner, or other material to be sprayed. Press the button, and the result is just like a store-bought aerosol. Made by Sprayon Products Inc, Cleveland 3, it's now going into national distribution through hardware stores, carries a list price of $3.95 for a complete Jet-Pak kit, as pictured (with an empty jar, of course). Refill propellant cans are $1.79.

A head start on keeping cool

To stay comfortable in hot weather—temporarily, at least—get yourself precooled. According to an Air Force report, tolerance to heat can be "increased significantly by prior cooling of the body," even in cases where high skin temperatures are reached. A precooled person, lightly clothed, Wright Air Development Center researchers say, can tolerate 160 F, without perspiring, for half an hour or more. A report on their studies—serious in intent—is obtainable from the Office of Technical Services, Washington 25, DC. (PB 151469, 20 p, 50¢)

For gayer growing grass

As it must to all things, engineering has come to the problem of trampled grass. The aim: to find out which types of grass are best able to stand the scuffing of children's shoes, the digging of golf and football spikes, the weight of people and moving vehicles. The method, devised by Prof R. L. Perry of UCLA, makes use of a Turfgrass Wear Tester that has four revolving wooden feet that simulate severe scuffing, two rollers covered with golf-shoe spikes, and a slanting golf-cart wheel. A small gasoline engine drives the whole assembly at about 8 rpm around a vertical axis on a 35-in. radius. The individual elements rotate at 100 rpm.

Results of tests on common grasses thus far: tall fescue and tifgreen Bermuda grass have the most wear resistance; Seaside bent and U-3 Bermuda the least.

Tests are continuing—goal is to establish a Turfgrass Traffic Tolerance index that takes into account recovery rate and other factors as well as straight wear.

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5	12	19	26	33	40	47	54	61	68	75	82	89	96	
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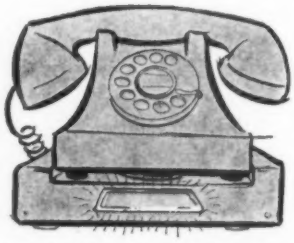
Why Don't They R and D . . .



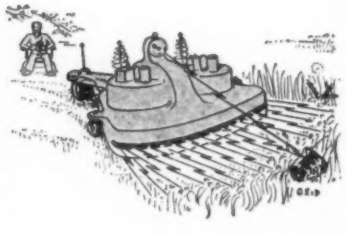
. . . an indicator for telephone party lines which would show the line was in use. This could be a simple induction pickup coil driving a transistorized circuit. Voices on the line would induce electric pulses in the coil which could be made to actuate a relay and light an indicator lamp. The whole device might fit in a base on which the phone would stand.—R. MARIE

. . . ultraviolet headlights for automobiles. This, in combination with fluorescent highways, highway markings and fluorescent tape on front and rear of automobiles would solve the problem of oncoming headlights blinding the driver. It would also allow him to see farther in fog. Similar ideas using polarized headlights have been tried but were not very successful. —E SELVI

. . . screens for windows, that would let the air in but keep dirt and dust out of homes that are not air conditioned. One possibility —an electrostatic barrier that charges dirt particles and then attracts them to an oppositely charged plate. This works (the Precipitron operates on this principle) but it involves fancy electronic gear that would be expensive, if not dangerous to install in each window. Perhaps a transparent honeycomb maze could be used. But some economical method would have to be found to flush out trapped dirt periodically. —R BLAGDEN

. . . a plastic coating which could be applied to the mating surfaces of weld tabs in such a way that a resistance weld through this waterproof material would give a waterproof seam. This would be quicker, and perhaps cheaper than conventional methods of making a waterproof seam. Would be particularly useful for making waterproof cases for electronic equipment. —R WALTERS

. . . a lawnmower which would cut grass quietly and efficiently and not require sharpening. How about a high-frequency mechanical vibrator . . . or beamed, high-intensity, microwave energy? Must, of course, be portable and should not require external power supply. —J E GEARY



Have you a problem, based on known scientific principles, which seems to have an answer somewhere within the limits of present technology? To inspire inventors along worthwhile paths, PRODUCT ENGINEERING invites you to trade such problems with fellow readers who may have a fresh viewpoint or more time for necessary R & D. We will pay $10 for each one accepted.

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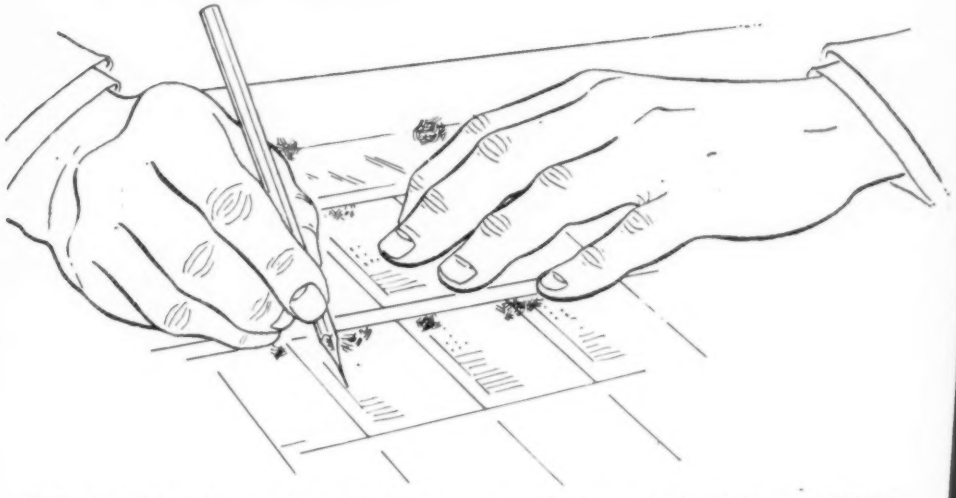

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